## Granf gr Cilley. <br> PERSONAL NARRATIVE <br> or <br> TRAVELS <br> TO THE <br> EQUINOCTIAL REGIONS <br> OF AMERICA,

DURING THE YEARS 1799-1804.
bY alexander von humboldt and aimé bonpland.
written in french by
ALEXANDER VON HUMBOLDT:

TRANSLATED AND EDITED BY THOMASINA ROSS
in three volumes. VOL. I.

## LONDON:

HENRI G. BOHN, YORK STREET, COVENT GARDEN. 1852.


PRINTED BY HARRISON AND SONS, london gazette office, st. martin's lane.


## EDITOR'S PREFAOE.

The increasing interest attached to all that part of the American Continent situated within and near the tropics, has suggested the publication of the present edition of Humboldt's celebrated work, as a portion of the Scientifio Library.

Prior to the travels of Humboldt and Bonpland, the countries described in the following narrative were but imperfectly known to Europeans. For our partial acquaintance with them we were chiefly indebted to the early navigators, and to some of the followers of the Spanish Conquistadores. The intrepid men whose courage and enterprise prompted them to explore unknown seas for the discovery of a New World, have left behind them narratives of their adventures, and descriptions of the strange lands and people they visited, which must ever be perused with curiosity and interest; and some of the followers of Pizarro and Cortez, as well as many learned Spaniards who proceeded to South America soon after the conquest, were the authors of historical and other works of high value. But these writings of a past age, however curious and interesting, are deficient in that spirit of scientific investigation which enhances the importance and utility of accounts of travels in distant regions. In more recent times, the researches of La Condamine tended in a most important degree to promote geographical knowledge; and he, as well as other eminent botanists who visited the coasts of South

America, and even ascended the Andes, contributed by their discoveries and collections to augment the vegetable riches of the Old World. But, in their time, geology as a science had little or no existence. Of the structure of the giant mountains of our globe scarcely anything was understood; whilst nothing was known beneath the earth in the New World, except what related to her mines of gold and silver.

It remained for Humboldt to supply all that was wanting, by the publication of his Personal Narrative. In this, more than in any other of his works, he shows his power of contemplating nature in all her grandeur and variety.

The researches and discoveries of Humboldt's able coadjutor and companion, M. Bonpland, afford not only a complete picture of the botany of the equinoctial regions of America, but of that of other places visited by the travellers on their voyage thither. The description of the Island of Teneriffe and the geography of its vegetation, show how mach was discovered by Humboldt and Bonpland which had escaped the observation of discerning travellers who had pursued the same route before them. Indeed, the whole account of the Canary Islands presents a picture which cannot be contemplated without the deepest interest, even by persons comparatively indifferent to the study of nature.

It is, perhaps, scancely necessary to remind the reader that since the time when this work was first published in Paris, the separation of the Spanish Colonies from the mother-country, together with subsequent political events, have wrought great changes in the governments of the South American States, as well as in the social condition of their inhabitants. One consequence of these changes has been to render obsolete some facts and observations relating to subjects, political, commercial, and statistical, interspersed through this work. However useful such matter might have been on its original publication, it is wholly irrelevant
to the existing state of things, and consequently it has been deemed advisable to omit it. By this curtailment, together with that of some meteorological tables and discessions of very limited interest, the work has been divested of its somewhat lengthy and discursive character, and condense within dimensions better adapted to the taste and requirements of the present time.

An English translation of this work by Helen Maria Williams, was published many years ago, and is now out of print. Though faultless as respects correctness of interpretation, it abounds in foreign turns of expression, and is somewhat deficient in that fluency of style without which a translated work is unsatisfactory to the Tinglish reader. In the edition now presented to the public it is hoped that these objections are in some degree removed.

A careful English version is given of all the Spanish and Portuguese terms, phrases, and quotations which occur in this work. Though the author has only in some few instances given a French translation of these passages, yet it is presumed that the interpretation of the whole in English will not be deemed superfluous; this new edition of the "Personal Narrative" having been undertaken with the view of presenting the work in the form best suited for the instruction and entertainment of the general reader.
T. $\mathbf{R}$

London, December 1851.

For the sake of accuracy, the French Measures, as given by the Author, and the indications of the Centigrade Thermometer, are retained in the translation, The following tables may, therefore, be found useful.

Tabir of Linear Mbabure.
1 toise $=6 \mathrm{ft} .4 .73 \mathrm{in}, \quad 1$ foot $=12.78 \mathrm{in} . \quad 1$ metre $=3 \mathrm{ft} .3 .37 \mathrm{in}$.
Centigrade Thermometer reduced to Fabrenhemts Scale.

| Cent. | Fahr. | Cent. | Fahr. | Cent. | Fahr. | Cent. | Fahr. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 100 | 212 | 65 | 149 | 30 | 86 | 5 | 23 |
| 99 | $210 \cdot 2$ | 64 | $147 \cdot 2$ | 29 | $84 \cdot 2$ | 6 | $21 \cdot 2$ |
| 98 | $208 \cdot 4$ | 63 | $145 \cdot 4$ | 28 | $82 \cdot 4$ | 7 | $19 \cdot 4$ |
| 97 | $206 \cdot 6$ | 62 | $143 \cdot 6$ | 27 | $80 \cdot 6$ | 8 | $17 \cdot 6$ |
| 96 | $204 \cdot 8$ | 61 | $141 \cdot 8$ | 26 | $78 \cdot 8$ | 9 | $15 \cdot 8$ |
| 95 | 203 | 60 | 140 | 25 | 77 | 10 | $14 \cdot$ |
| 94 | $201 \cdot 2$ | 59 | $138 \cdot 2$ | 24 | $75 \cdot 2$ | 11 | $12 \cdot 2$ |
| 93 | $199 \cdot 4$ | 58 | $136 \cdot 4$ | 23 | $73 \cdot 4$ | 12 | $10 \cdot 4$ |
| 92 | $197 \cdot 6$ | 57 | $134 \cdot 6$ | 22 | $71 \cdot 6$ | 13 | $8 \cdot 6$ |
| 91 | 195.8 | 56 | $132 \cdot 8$ | 21 | $69 \cdot 8$ | 14 | $6 \cdot 8$ |
| 90 | 194 | 55 | 131 | 20 | 68 | 15 | 5 |
| 89 | $192 \cdot 2$ | 54 | $129 \cdot 2$ | 19 | $66 \cdot 2$ | 16 | $3 \cdot 2$ |
| 88 | $190 \cdot 4$ | 53 | $127 \cdot 4$ | 18 | $64 \cdot 4$ | 17 | $1 \cdot 4$ |
| 87 | $188 \cdot 6$ | 52 | 125.6 | 17 | $62 \cdot 6$ | 18 | $-0 \cdot 4$ |
| 86 | $186 \cdot 8$ | 51 | $123 \cdot 8$ | 16 | $60 \cdot 8$ | 19 | 2.2 |
| 85 | 185 | 50 | $122 \cdot$ | 15 | 59 | 20 | 4 |
| 84 | $183 \cdot 2$ | 49 | $120 \cdot 2$ | 14 | $57 \cdot 2$ | 21 | $5 \cdot 8$ |
| 83 | $181 \cdot 4$ | 48 | $118 \cdot 4$ | 13 | $55 \cdot 4$ | 22 | $7 \cdot 6$ |
| 82 | $179 \cdot 6$ | 47 | $116 \cdot 6$ | 12 | $53 \cdot 6$ | 23 | $9 \cdot 4$ |
| 81 | $177 \cdot 8$ | 46 | $114 \cdot 8$ | 11 | $51 \cdot 8$ | 24 | $11 \cdot 2$ |
| 80 | 176 | 45 | 113 | 10 | 50 | 25 | 13 |
| 79 | $174 \cdot 2$ | 44 | $111 \cdot 2$ | 9 | $48 \cdot 2$ | 26 | $14 \cdot 8$ |
| 78 | $172 \cdot 4$ | 43 | $109 \cdot 4$ | 8 | $46 \cdot 4$ | 27 | $16 \cdot 6$ |
| 77 | $170 \cdot 6$ | 42 | $107 \cdot 6$ | 7 | $44 \cdot 6$ | 28 | $18 \cdot 4$ |
| 76 | $168 \cdot 8$ | 41 | $105 \cdot 8$ | 6 | $42 \cdot 8$ | 29 | $20 \cdot 2$ |
| 75 | 167 | 40 | 104 | 5 | 41 | 30 | 22 |
| 74 | $165 \cdot 2$ | 39 | $102 \cdot 2$ | 4 | $39 \cdot 2$ | 31 | $23 \cdot 8$ |
| 73 | $163 \cdot 4$ | 38 | $100 \cdot 4$ | 3 | $37 \cdot 4$ | 32 | $25 \cdot 6$ |
| 72 | $161 \cdot 6$ | 37 | $98 \cdot 6$ | 2 | $35 \cdot 6$ | 33 | $27 \cdot 4$ |
| 71 | $159 \cdot 8$ | 36 | $96 \cdot 8$ | 1 | $33 \cdot 8$ | 34 | $29 \cdot 2$ |
| 70 | 158 | 35 | 95 | 0 | 32 | 35 | 31 |
| 69 | $156 \cdot 2$ | 34 | $93 \cdot 2$ | -1 | $30 \cdot 2$ | 36 | $32 \cdot 8$ |
| 68 | $154 \cdot 4$ | 33 | $91 \cdot 4$ | 2 | $28 \cdot 4$ | 37 | $34 \cdot 6$ |
| 67 | $152 \cdot 6$ | 32 | $89 \cdot 6$ | 3 | $26 \cdot 6$ | 38 | $36 \cdot 4$ |
| 66 | $150 \cdot 8$ | 31 | $87 \cdot 8$ | 4 | $24 \cdot 8$ | 39 | $38 \cdot 2$ |
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# INTRODUCTION, 

## BY

THE AUTHOR.

Mary years have elapsed since' I quitted Europe, to explore the interior of the New Continent. Devoted from my earliest youth to the study of nature, feeling with enthusiasm the wild beauties of a country guarded by mountains and shaded by ancient forests, I experienced in my travels, enjoyments which have amply compensated for the privations inseparable from a laborious and often agitated life. These enjoyments, which I endeavoured to impart to my readers in my 'Remarks upon the Steppes,' and in the 'Essay on the Physiognomy of Plants,' were not the only fruits I reaped from an undertaking formed with the design of contributing to the progress of natural philosophy. I had long prepared myself for the observations which were the principal object of my journey to the torrid zone. I was provided with instruments of easy and convenient use, constructed by the ablest makers, and I enjoyed the special protection of a government which, far from presenting obstacles to my investigations, constantly honoured me with every mark of regard and confidence. I was aided by a courageous and enlightened friend, and it was singularly propitious to the success of our participated labour, that the zeal and equanimity of that friend never failed, amidst the fatigues and dangers to,which we were sometimes exposed.
Under these favourable circumstances, traversing regions which for ages have remained almost unknown to most of the nations of Europe, I might add even to Spain, M. Bonpland and myself collected a considerable number of materials, the publication of which may throw some light on the history of nations, and advance the study of nature.
I had in view a two-fold purpose in the travels of which I now. publish the historical narrative. I wished to make known the countries I had visited; and to collect such facts as are fitted to elucidate a science of which we as yet possess scarcely the outline, and which has been vaguely donominated Natural His-

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tory of the World, Theory of the Earth, or Physical Geography. The last of these two objects seemed to me the most important. I was passionately devoted to botany and certain parts of zoology, and I flattered myself that our investigations might add some new species to those already known, both in the animal and vegetable kingdoms; but preferring the connection of facts which have been long observed, to the knowledge of insulated facts, although new, the discovery of an unknown genus seemed to me far less interesting than an observation on the geographical relations of the vegetable world, on the migrations of the social plants, and the limit of the height which their different tribes attain on the flanks of the Cordilleras.

The natural sciences are connected by the same ties which link together all the phenomena of nature. The classification of the species, which must be considered as the fundamental part of botany, and the study of which is rendered attractive and easy by the introduction of natural methods, is to the geography of plants what descriptive mineralogy is to the indication of the rocks constituting the exterior crust of the globe. To comprehend the laws observed in the position of these rocks, to determine the age of their successive formations, and their identity in the most distant regions, the geologist should be previously acquainted with the simple fossils which compose the mass of mountains, and of which the names and character are the object of oryctognostical knowledge. It is the same with that part of the natural history of the globe which treats of the relations plants have to each other, to the soil whence they spring, or to the air which they inhale and modify. The progress of the geography of plants depends in a great measure on that of descriptive botany; and it would be injurious to the advancement of science, to attempt rising to general ideas, whilst neglecting the knowledge of particular facts.

I have been guided by these considerations in the course of my inquiries; they were always present to my mind during the period of my preparatory studies. When I began to read the numerous narratives of travels, which compose so interesting a part of modern literature, I regretted that travellers, the most enlightened in the insulated branches of natural history, were seldom possessed of sufficient variety of knowledge to avail themselves of every advantage arising from their position. It appeared to me, that the importance of the results hitherto obtained did not keep pace with the immense progress which, at the end of the eighteenth century, had been made in several departments of science, particularly geology, the history of the modifications of the atmosphere, and the physiology of animals and plants. I saw with regret, (and all scientific men have shared this feeling) that whilst the number of accurate instruments was daily in-
creasing, we were still ignorant of the height of many mountains and elevated plains; of the periodical oscillations of the aërial ocean; of the limit of perpetual snow within the polar circle and on the borders of the torrid zone; of the variable intensity of the magnetic forces, and of many other phenomena equally important.

Maritime expeditions and circumnavigatory voyages have conferred just celebrity on the names of the naturalists and astronomers who have been appointed by various governments to share the dangers of those undertakings; but though these eminent men have given us precise notions of the external configuration of countries, of the natural history of the ocean, and of the productions of islands and coasts, it must be admitted that maritime expeditions are less fitted to advance the progress of geology and other parts of physical science, than travels into the interior of a continent. The advancement of the natural sciences has been subordinate to that of geography and nautical astronomy. During a voyage of several years, the land but seldom presents itself to the observation of the mariner; and when, after lengthened expectation, it is descried, he often finds it stripped of its most beautiful productions. Sometimes, beyond a barren coast, he perceives a ridge of mountains covered with verdure, but its distance forbids examination, and the view serves only to excite regret.

Journeys by land are attended with considerable difficulties in the conveyance of instruments and collections, but these difficulties are compensated by advantages which it is unnecessary to enumerate. It is not by sailing along a coast that we can discover the direction of chains of mountains, and their geological constitution, the climate of each zone, and its influence on the forms and habits of organized beings. In proportion to the extent of continents, the greater on the surface of the soil are the riches of animal and vegetable productions; the more distant the central chain of mountains from the sea-shore, the greater is the variety in the bosom of the earth, of those stony strata, the regular succession of which unfolds the history of our planet. As every being considered apart is impressed with a particular type, so, in like manner, we find the same distinctive impression in the arrangement of brute matter organized in rocks, and also in the distribution and mutual relations of plants and animals. The great problem of the physical description of the globe, is the determination of the form of these types, the laws of their relations with each other, and the eternal ties which link the phenomena of life, and those of inanimate nature.

Having stated the general object I had in view in my expeditions, I will now hasten to give a slight sketch of the whole of the collections and observations which we have accumulated,
and the union of which is the aim and end of every scientific journey. The maritime war, during our abode in America, having rendered communication with Europe very uncertain, we found ourselves compelled, in order to diminish the chance of losses, to form three different collections. Of these, the first was embarked for Spain and France, the second for the United States and England, and the third, which was the most considerable, remained almost constantly under our own eyes. Towards the close of our expedition, this last collection formed forty-two boxes, containing an herbal of six thousand equinoctial plants, seeds, shells, insects, and (what had hitherto never been brought to Europe) geological specimens, from the Chimborazo, New Grenada, and the banks of the river Amazon.

After our journey to the Orinoco, we left a part of these collections at the island of Cuba, intending to take them on our return from Peru to Mexico. The rest followed us during the space of five years, on the chain of the Andes, across New Spain, from the shores of the Pacific to the coasts of the Caribbean Sea. The conveyance of these objects, and the minute care they required, occasioned embarrassments scarcely conceiveable even by those who have traversed the most uncultivated parts of Europe. Our progress was often retarded by the necessity of dragging after us, during expeditions of five or six months, twelve, fifteen, and sometimes more than twenty loaded mules, exchanging these auimals every eight or ten days, and superintending the Indians who were employed in driving the numerous caravan. Often, in order to add to our collections of new mineral substances, we found ourselves obliged to throw away others, which we had collected a considerable time before. These sacrifices were not less vexatious than the losses we accidentally sustained. Sad experience taught us but too late, that from the sultry humidity of the climate, and the frequent falls of the beasts of burden, we could preserve neither the skins of animals hastily prepared, nor the fishes and reptiles placed in phials filled with alcohol. I enter into these details, because, though little interesting in themselves, they serve to show that we had no means of bringing . back, in their natural state, many objects of zoology and comparative anatomy, of which we have published descriptions and drawings. Notwithstanding some obstacles, and the expense occa.sioned by the carriage of these articles, I had reason to applaud the resolution I had taken before my departure, of sending to Europe the duplicates only of the productions we collected. I cannot too often repeat, that when the seas are infested with privateers, a traveller can be sure only of the objects in his own possession. A very few of the duplicates, which we shipped for Curope during our abode in America, were saved; the greater part fell into the hands of persons who feel no interest for
:science. When a ship is condemned in a foreign port, bores contsining only dried plants or stones, instead of being sent to the scientific men to whom they are addressed, are put aside and forgotten. Some of our geological collections taken in the Pacific were, however, more fortunate. We were indebted for their preservation to the generous activity of Sir Joseph Banks, President of the Royal Society of London, who, amidst the political agitations of Europe, unceasingly laboured to strengthen the bonds of union between scientific men of all nations.

In our investigations we have considered each phenomenon under different aspects, and classed our remarks according to the relations they bear to each other. To afford an idea of the method we have followed, I will here add a succinct enumeration of the materials with which we were furnished for describing the volcanos of Antisana and Pichincha, as well as that of Jorullo : the latter, during the night of the 20th of September, 1759, rose from the earth one thousand five hundred and seventyeight French feet above the surrounding plains of Mexico. The position of these singular mountains in longitude and latitude was ascertained by astronomical observations. We took the heights of the different parts by the aid of the barometer, and determined the dip of the needle and the intensity of the magnetic forces. Our collections contain the plants which are spread over the flanks of these volcanos, and specimens of different rocks which, superposed one upon another, constitute their external coat. We are enabled to indicatc, by measures sufficiently exact, the height above the level of the ocean, at which we found each group of plants, and each volcanic rock. Our journals furnish us with a series of observations on the humidity, the temperature, the electricity, and the degree of transparency of the air on the brinks of the craters of Pichincha and Jorullo; they also contain topographical plans and geological profiles of these mountains, founded in part on the measure of vertical bases, and on angles of altitude. Each observation has been calculated according to the tables and the methods which are considered most exactis the present state of our knowledge; and in order to judge of the degree of confidence which the results may claim, we have preserved the whole detail of our partial operations.

It would have been possible to blend these different materials in a work devoted wholly to the description of the volcanos of Peru and New Spain. Had I given the physical description of a siagle province, I could have treated separately everything relating to its geography, mineralogy, and botany; but how could - I interrupt the narrative of a journey, a disquisition on the manners of a people, or the great phenomena of nature, by an enumeration of the productions of the country, the description :of new species of animals and plants, or the detail of astrone-
mical observations. Had I adopted a mode of composition which would have included in one and the same chapter all that has been observed on one particular point of the globe, I should have prepared a work of cumbrous length, and devoid of that clearness which arises in a great measure from the methodical distribution of matter. Notwithstanding the efforts I have made to avoid, in this narrative, the errors I had to dread, I feel conscious that I have not always succeeded in separating the observations of detail from those general results which interest every enlightened mind. These results comprise in one view the climate and its influence on organized beings, the aspect of the country, varied according to the nature of the soil and its vegetable covering, the direction of the mountains and rivers which? separate races of men as well as tribes of plants; and finally, the modifications observable in the condition of people living in different latitudes, and in circumstances more or less favourable: to the development of their faculties. I do not fear having too much enlarged on objects so worthy of attention: one of the noblest characteristics which distinguish modern civilization from that of remoter times is, that it has enlarged the mass of our conceptions, rendered us more capable of perceiving the connection. between the physical and intellectuai world, and thrown a more general interest over objects which heretofore occupied only a: few scientific men, because those objects were contemplated separately, and from a narrower point of view.

As it is probable that these volumes will obtain the attention of a greater number of readers than the detail of my observations merely scientific, or my researches on the population, the commerce, and the mines of New Spain, I may be permitted here to enumerate all the works which I have hitherto published conjointly with M. Bonpland. When several works are interwoven in some sort with each other, it may perhaps be interesting to the reader to know the sources whence he may obtain more circumstantial information.
I. Astronomical observations, trigonometrical operations, and $b a$ rometrical measurements made during the course of a journey to the equinoctial regions of the New Continent, from 1799 to 1804. This work, to which are added historical researches on the position of several points important to navigators, contains, first, the original observations which I made from the twelfth degree of southern to the forty-first degree of northern latitude ; the transits of the sun and stars over the meridian; distances of the moon from the sun and the stars; occultations of the satellites; eclipses of the sun and moon; transits of Mercury over the disc of the sun ; azimuths; circum-meridian altitudes of the moon, to determine the longitude by the differences of declination; researches on the relative intensity of the light of the
austral stars; geodesical measures, \&c. Secondly, a treatise on the astronomical refractions in the torrid zone, considered as the effect of the decrement of caloric in the strata of the air; thirdly, the barometric measurement of the Cordillera of the Andes, of Mexico, of the province of Venezuela, of the kingdom of Quito, and of New Grenada; followed by geological observations, and containing the indication of four hundred and fiftythree heights, calculated according to the method of M. Laplace, and the new co-efficient of M. Ramond ; fourthly, a table of near seven hundred geographical positions on the New Continent; two hundred and thirty-five of which have been determined by my own observations, according to the three co-ordinates of longitude, latitude, and height.
II. Equinoctial plants collected in Mexico, in the island of Cuba, in the provinces of Caracas, Cumana, and Barcelona, on the Andes of New Grenada, Quito, and Peru, and on the banks of the Rio Negro, the Orinoco, and the River Amazon. M. Bonpland has in this work given figures of more than forty new genera of plants of the torrid zone, classed according to their natural families. The methodical descriptions of the species are both in French and in Latin, and are accompanied by observations on the medicinal properties of the plants, their use in the arts, and the climate of the countries in which they are found.
III. Monography of the Melastoma, Rhexia, and other genera of this order of plants, comprising upwards of a hundred and fifty species of melastomaceæ, which we collected during the course of our expeditions, and which form one of the most beautiful ornaments of tropical vegetation. M. Bonpland has added the plants of the same family, which, among many other rich stores of natural history, M. Richard collected in his interesting expedition to the Antilles and French Guiana, and the descriptions of which he has communicated to us.
IV. Essay on the geography of plants, accompanied by a physical table of the equinoctial regions, founded on measures taken from the tenth degree of northern to the tenth degree of southern latitude. I have endeavoured to collect in one point of view the whole of the physical phenomena of that part of the New Continent comprised within the limits of the torrid zone from the level of the Pacific.to the highest summit of the Andes; namely, the vegetation, the animals, the geological relations, the cultivation of the soil, the temperature of the air, the limit of perpetual snow, the chemical constitution of the atmosphere, its electrical intensity, its barometrical pressure, the decrement of gravitation, the intensity of the azure colour of the sky, the diminution of light during its passage through the successive strata of the air, the horizontal refractions, and the heat of boiling water at different heights. Fourteen scales, disposed side by side with a
profile of the Andes, indicate the modifications to which these phenomena are subject from the influence of the elevation of the soil above the level of the sea. Each group of plants is placed at the height which nature has assigned to it, and we may follow the prodigious variety of their forms from the region of the palms and arborescent ferns to those of the johannesia (chuquiraga, Juss.), the gramineous plants, and lichens. These regions form the natural divisions of the vegetable empire; and as perpetual snow is found in each climate at a determinate height, so, in like manner, the febrifuge species of the quinquina (cinchona) have their fixed limits, which I have marked in the botanical chart belonging to this essay.
V. Observations on Zoology and Comparative Anatomy. I have comprised in this work the history of the condor ; experiments on the electrical action of the gymnotus; a treatise on the larynx of the crocodiles, the quadrumani, and birds of the tropics; the description of several new species of reptiles, fishes, :birds, monkeys, and other mammalia but little known. M. Cuvier has enriched this work with a very comprehensive treatise on the axolotl of the lake of Mexico, and on the genera of the Protei. That naturalist has also recognized two new species of :mastodons and an elephant among the fossil bones of quadrupeds which we brought from North and South America. For the description of the insects collected by M. Bonpland we are indebted to M. Latreille, whose labours have so much contributed to the progress of entomology in our times. The second volume of this work contains figures of the Mexican, Peruvian, and Aturian skulls, which we have deposited in the Museum of Natural History at Paris, and respecting which Blumenbach has published observations in the 'Decas quinta Craniorum diversarum gentium.'
VI. Political essay on the kingdom of New Spain, with a physical and geographical Atlas, founded on astronomical observations and trigonometrical and barometrical measurements. This work, based on numerous official memoirs, presents, in six divisions, considerations on the extent and natural appearance of Mexico, on the population, on the manners of the inhabitants, their ancient civilization, and the political division of their territory. It embraces also the agriculture, the mineral riches, the manufactures, the commerce, the finances, and the military defence of that vast country. In treating these different subjects I have endeavoured to consider them under a general point of view; I have drawn a parallel not only between New Spain, the other Spanish colonies, and the United States of North America, but also between New Spain and the possessions of the English in Asia; I have compared the agriculture of the countries situated in the torrid zone with that of the temperate climates; and I have examined the quantity of colonial produce
necessary to Europe in the present state of civilization. In tracing the geological description of the richest mining districts in Mexico, I have, in short, given a statement of the mineral produce, the population, the imports and exports of the whole of Spanish America. I have examined several questions which, for want of precise data, had not hitherto been treated with the attention they demand, such as the influx and reflux of metals, their progressive accumulation in Europe and Asia, and the quantity of gold and silver which, since the discovery of America down to our own times, the Old World has received from the New. The geographical introduction at the beginning of this work contains the analysis of the materials which have been employed in the construction of the Mexican Atlas.
VII. Views of the Cordilleras, and nonuments of the indigenous nations of the New Continent.* This work is intended to represent a few of the grand scenes which nature presents in the lofty chain of the Andes, and at the same time to throw some light on the ancient civilization of the Ancricans, through the study of their monuments of architecture, their hieroglyphics, their religious rites, and their astrological reveries. I have given in this work a description of the teocalli, or Mexican pyramids, and have compared their structure with that of the temple of Belus. I have described the arabesques which cover the ruins of Mitla, the idols in basalt ornamented with the calantica of the heads of Isis; and also a considerable number of symbolical paintings, representing the serpent-woman (the Mexican Eve), the deluge of Coxcox, and the first migrations of the natives of the Aztec race. I have endeavoured to prove the striking analogies existing between the calendar of the Toltecs and the catasterisms of their zodiac, and the division of time of the people of Tartary and Thibet, as well as the Mexican traditions on the four regenerations of the globe, the pralayas of the Hindoos, and the four ages of Hesiod. In this work I have also included (in addition to the hieroglyphical paintings I brought to Europe), fragments of all the Aztec manuscripts, collected in Rome, Veletri, Vienna, and Dresden, and one of which reminds us, by its lineary symbols, of the kouas of the Chinese. Together with the rude monuments of the aborigines of America, this volume contains picturesque views of the mountainous countries which those people inhabited; for example, the cataract of Tequendama, Chimborazo, the volcano of Jorullo, and Cayambe, the pyramidal summit of which, covered with eternal ice, is situated directly under the equinoctial line. In every zone the configuration of the ground, the physiognomy

* Atlas Pittoresque, ou Vues des Cordillères, 1 vol. folio, with 69 plates, part of which are coloured, accompanied by explanatory treatises. This work may be considered as the Atlas to the historical narrative of the travels.
of the plants, and the aspect of lovely or wild scenery, have great influence on the progress of the arts, and on the style which distinguishes their productions. This influence is so much the more perceptible in proportion as man is farther removed from civilization.

I could have added to this work researches on the character of languages, which are the most durable monuments of nations I have collected a number of materials on the languages of America, of which MM. Frederic Schlegel and Vater have made use ; the former in his Considerations on the Hindoos, the latter in his Continuation of the Mithridates of Adelung, in the Ethnographical Magazine, and in his Inquiries into the Population of the New Continent. These materials are now in the hands of my brother, William von Humboldt, who, during his travels in Spain, and a long abode at Rome, formed the richest collection of American vocabularies in existence. His extensive knowledge of the ancient and modern languages has enabled him to trace some curious analogies in relation to this subject, so important to the philosophical study of the history of man. A part of his labours will find a place in this narrative.

Of the different works which I have here enumerated, the second and third were composed by M. Bonpland, from the observations which he made in a botanical journal. This journal contains more than four thousand methodical descriptions of equinoctial plants, a ninth part only of which have been made by me. They appear in a separate publication, under the title of Nova Genera et Species Plantarum. In this work will be found, not only the new species we collected, which, after a careful examination by one of the first botanists of the age, Prof. Willdenow, are computed to amount to fourteen or fifteen hundred, but also the interesting observations made by M. Bonpland on plants hitherto imperfectly described. The plates of this work are all engraved according to the method followed by M. Labillardière, in the Specimen Plantarum Novae Hollandice, a work remarkable for profound research and clearness of arrangement.

After having distributed into separate works all that belongs to astronomy, botany, zoology, the political description of New Spain, and the history of the ancient civilization of certain nations of the New Continent, there still remained many general results and local descriptions, which I might have collected into separate treatises. I had, during my journey, prepared papers. on the races of men in South America; on the Missions of the Orinoco; on the obstacles to the progress of society in the torrid zone arising from the climate and the strength of vegetation; on the character of the landscape in the Cordilleras of the Andes compared with that of the Alps in Switzerland; on the analogies
between the rocks of the two hemispheres; on the physical constitution of the air in the equinoctial regions, \&cc. I had left Europe with the firm intention of not writing what is usually called the historical narrative of a journey, but to publish the fruit of my inquiries in works merely descriptive; and I had arranged the facts, not in the order in which they successively presented themselves, but according to the relation they bore to each other. Amidst the overwhelming majesty of Nature, and the stupendous objects she presents at every step, the traveller is little disposed to record in his journal matters which relate only to himself, and the ordinary details of life.

I composed a very brief itinerary during the course of my excursions on the rivers of South America, and in my long journies by land. I regularly described (and almost always on the spot) the visits I made to the summits of volcanos, or mountains remarkable for their height ; but the entries in my journal were interrupted whenever I resided in a town, or when other occupations prevented me from continuing a work which I considered as having only a secondary interest. Whenever I wrote in my journal, I had no other motive than the preservation of some of those fugitive ideas which present themselves to a naturalist, whose life is almost wholly passed in the open air. I wished to make a temporary collection of such facts as I had not then leisure to class, and note down the first impressions, whether agreeable or painful, which I received from nature or from man. Far from thinking at the time that those pages thus hurriedly written would form the basis of an extensive work to be offered to the public, it appeared to me, that my journal, though it might furnish certain data useful to science, would present very few of those incidents, the recital of which constitutes the principal charm of an itinerary.

The difficulties I have experienced since my return, in the composition of a considerable number of treatises, for the purpose of making known certain classes of phenomena, insensibly overcame my repugnance to write the narrative of my journey. In undertaking this task, I have been guided by the advice of many estimable persons, who honour me with their friendship. I also perceived that such a preference is given to this sort of composition, that scientific men, after having presented in an isolated form the account of their researches on the productions, the manners, and the political state of the countries through which they have passed, imagine that they have not fulfilled their engagements with the public, till they have written their itinerary.

An historical narrative embraces two very distinct objects; the greater or the less important events connected with the purpose of the traveller, and the observations he has made during his journey. The unity of composition also, which distinguishes
good works from those on an ill-constructed plan, can be strictly observed only when the traveller describes what has passed. under his own eye ; and when his principal attention has been fixed less on scientific observations than on the manners of different people and the great phenomena of nature. Now, the most faithful picture of manners is that which best displays the relations of men towards each other. The character of savage or civilized life is portrayed either in the obstacles a traveller meets with, or in the sensations he feels. It is the traveller himself whom we continually desire to see in contact with the objects which surround him; and his narration interests us the. more, when a local tint is diffused over the description of a country and its inhabitants. Such is the source of the interest. excited by the history of those early navigators, who, impelled by intrepidity rather than by science, struggled against the elements in their search for the discovery of a new world. Such is the irresistible charm attached to the fate of that enterprising traveller,* who, full of enthusiasm and energy, penetrated alone into the centre of Africa, to discover amidst barbarous nations the traces of ancient civilization.

In proportion as travels have been andertaken by persons whose views have been directed to researches into descriptive natural history, geography, or political economy, itineraries have partly lost that unity of composition, and that simplicity which characterized those of former ages. It is now become scarcely possible to connect so many different materials with the detail of other events; and that part of a traveller's narrative which we may call dramatic gives way to dissertations merely descriptive. The numerous class of readers who prefer agreeable amusement to solid instruction, have not gained by the exchange; and I am afraid that the temptation will not be great to follow. the course of travellers who are incumbered with scientific instruments and collections.

To give greater variety to my work, I have often interrupted the historical narrative by descriptions. I first represent phenomena in the order in which they appeared ; and I afterwards consider them in the whole of their individual relations. This mode has been successfully followed in the journey of M. de Saussure, whose most valuable work has contributed more than any other to the advancement of science. Often, amidst dry discussions on meteorology, it contains many charming descriptions ; such as those of the modes of life of the inhabitants of the mountains, the dangers of hunting the chamois, and the sensations felt on the summit of the higher Alps.

There are details of ordinary life which it may be useful to

[^0]note in an itinerary, because they serve for the guidance of those who afterwards journey through the same countries. I have preserved a few, but have suppressed the greater part of those personal incidents which present no particular interest, and which can be rendered amusing only by the perfection of style.
With respect to the country which has been the object of my investigations, I am fully sensible of the great advantages enjoyed by persons who travel in Greoce, Egypt, the banks of the Euphrates, and the islands of the Pacific, in comparison with those who traverse the continent of America. In the Old World, nations and the distinctions of their civilization form the principal points in the picture; in the New World, man and his productions almost disappear amidst the stupendous display of wild and gigantic nature. The human race in the New World presents only a few remnants of indigenous hordes, slightly advanced in civilization; or it exhibits merely the uniformity of manners and institutions transplanted by European colonists to foreign shores. Information which relates to the history of our species, to the various forms of government, to monuments of art, to places full of great remembrances, affect us far more than descriptions of those vast solitudes which seem destined only for the development of vegetable life, and to be the domain of wild animals. The savages of America, who have been the objects of $s 0$ many systematic reveries, and on whom M. Volney has lately published some accurate and intelligent observations, inspire less interest since celebrated navigators have made known to us the inhabitants of the South Sea islands, in whose character we find a striking mixture of perversity and meekness. The state of half-civilization existing among those islanders gives a peculiar charm to the description of their manners. A king, followed by a numerous suite, presents the fruits of his orchard; or a. funeral is performed amidst the shade of the lofty forest. Such pictures, no doubt, have more attraction than those which pourtray the solemn gravity of the inhabitant of the banks of the Missouri or the Marañon.

America offers an ample field for the labours of the naturalist. On no other part of the globe is he called upon more powerfully by nature to raise himself to general ideas on the cause of phenomena and their matual connection. To say nothing of that luxuriance of vegetation, that eternal spring of organic life, those climates varying by stages as we climb the flanks of the Cordilleras, and those majestic rivers which a celebrated writer* has described with such graceful accuracy, the resources which the New World affords for the study of geology and natural

* M. Chateaubriand.
philosophy in general have been long since acknowledged. Happy the traveller who may cherish the hope that he has availed himself of the advantages of his position, and that he has added some new facts to the mass of those previously acquired!

Since I left America, one of those great revolutions, which at certain periods agitate the human race, has broken out in the Spanish colouies, and seems to prepare new destinies for a population of fourteen millions of inhabitants, spreading from the southern to the northern hemisphere, from the shores of the Rio de la Plata and Chile to the remotest part of Mexico. Deep resentments, excited by colonial legislation, and fostered by mistrustful policy, have stained with blood regions which had enjoyed, for the space of nearly three centuries, what I will not call happiness but uninterrupted peace. At Quito several of the most virtuous and enlightened citizens have perished, victims of devotion to their country. While I am giving the description of regions, the remembrance of which is so dear to me, I continually light on places which recall to my mind the loss of a friend.

When we reflect on the great political agitations of the New World, we observe that the Spanish Americans are by no means in so favourable a position as the inhabitants of the United States; the latter having been prepared for independence by the long enjoyment of constitutional liberty. Internal dissensions are chiefly to be dreaded in regions where civilization is but slightly rooted, and where, from the influence of climate, forests may soon regain their empire over cleared lands if their culture be abandoned. It may also be feared that, during a long series of years, no foreign traveller will be enabled to traverse all the countries which I have visited. This circumstance may perhaps add to the interest of a work which pourtrays the state of the greater part of the Spanish colonies at the beginning of the 19th century. I even venture to indulge the hope that this work will be thought worthy of attention when passions shall be hushed into peace, and when, under the influence of a new social order, those countries shall have made rapid progress in public welfare. If then some pages of my book are snatched from oblivion, the inhabitant of the banks of the Orinoco and the Atabapo will behold with delight populous cities enriched by commerce, and fertile fields cultivated by the hands of free men, on those very spots where, at the time of my travels, I found only impenetrable forests and inundated lands.

# PERSONAL NARRATIVE <br> OF A 

JOURNET
TO THE
EQUINOCTIAL REGIONS
or
THE NEW CONTINENT.

Chapter I.<br>Preparations.-Instruments.-Departure from Spain.-Landing at the Canary Islands.

From my earliest youth I felt an ardent desire to travel into distant regions, seldom visited by Europeans. This desire is characteristic of a period of our existence when life appears an unlimited horizon, and when we find an irresistible attraction in the impetuous agitations of the mind, and the image of positive danger. Though educated in a country which has no direct communication with either the East or the West Indies, living amidst mountains remote from coasts, and celebrated for their numerous mines, I felt an increasing passion for the sea and distant expeditions. Objects with which we are acquainted only by the animated narratives of travellers have a peculiar charm; imagination wanders with delight over that which is vague and undefined; and the pleasures we are deprived of seem to possess a fascinating power, compared with which all we daily feel VOL. I .
in the narrow circle of sedentary life appears insipid. The taste for herborisation, the study of geology, rapid excursions to Holland, England, and France, with the celebrated Mr. George Forster, who had the happiness to accompany captain Cook in his second expedition round the globe, contributed to give a determined direction to the plan of travels which I had formed at eighteen years of age. No longer deluded by the agitation of a wandering life, I was anxious to contemplate nature in all her variety of wild and stupendous scenery; and the hope of collecting some facts useful to the advancement of science, incessantly impelled my wishes towards the luxuriant regions of the torrid zone. As personal circumstances then prevented me from executing the projects by which I was so powerfully influenced, I had leisure to prepare myself during six years for the observations I proposed to make on the New Continent, as well as to visit different parts of Europe, and to explore the lofty chain of the Alps, the structure of which I might afterwards compare with that of the Andes of Quito and of Peru.

I had traversed a part of Italy in 1795, but had not been able to visit the volcanic regions of Naples and Sicily; and I regretted leaving Europe without having seen Vesuvius, Stromboli, and Etna. I felt, that in order to form a proper judgment of many geological phenomena, especially of the nature of the rocks of trap-formation, it was necessary to examine the phenomena presented by burning volcanoes. I determined therefore to return to Italy in the month of November, 1797. I made a long stay at Vienna, where the fine collections of exotic plants, and the friendship of Messrs. de Jacquin, and Joseph van der Schott, were highly useful to my preparatory studies. I travelled with M. Leopold von Buch, through several cantons of Salzburg and Styria, countries alike interesting to the landscape-painter and the geologist; but just when I was about to cross the Tyrolese Alps, the war then raging in Italy obliged me to abandon the project of going to Naples.

A short time before, a gentleman passionately fond of the fine arts, and who had visited the coasts of Greece and Illyria to inspect their monuments, made me a proposal to accompany him in an expedition to Upper Egypt. This
expedition was to occupy only eight months. Provided with astronomical instruments and able draughtsmen, we were to ascend the Nile as far as Assouan, after minutely examining the positions of the Saïd, between Tentyris and the cataracts. Though my views had not hitherto been fixed on any region but the tropics, I could not resist the temptation of visiting countries so celebrated in the annals of human civilization. I therefore accepted this proposition, but with the express condition, that on our return to Alexandria I should be at liberty to continue my journey through Syria and Palestine. The studics which I entered upon with a view to this new project, I afterwards found useful, when I examined the relations between the barbarous monuments of Mexico, and those belonging to the nations of the old world. I thought myself on the point of embarking for Egypt, when political events forced me to abandon a plan which promised me so much satisfaction.
An expedition of discovery in the South Sea, under the direction of captain Baudin, was then preparing in France. The plan was great, bold, and worthy of being executed by a more enlightened commander. The purpose of this expedition was to visit the Spanish possessions of South America, from the mouth of the river Plata to the kingdom of Quito and the isthmus of Panama. After visiting the archipelago of the Pacific, and exploring the coasts of New Holland, from Van Diemen's Land to that of Nuyts, both vessels were to stop at Madagascar, and return by the Cape of Good Hope. I was in Paris when the preparations for this voyage were begun. I had but little confidence in the personal character of captain Baudin, who had given cause of discontent to the court of Vienna, when he was commissioned to conduct to Brazil one of my friends, the young botanist, Van der Schott; but as I could not hope, with my own resources, to make a voyage of such extent, and view so fine a portion of the globe, I determined to take the chances of this expedition. I obtained permission to embark, with the instruments I had collected, in one of the vessels destined for the South Sea, and I reserved to myself the liberty of leaving captain Baudin whenever I thought proper. M. Michaux, who had already visited Persia and a part of North America, and M. Bonpland, with whom I B-2
then formed the friendship that still unites us, were appointed to accompany this expedition as naturalists.

I had flattered myself during several months with the idea of sharing the labours directed to so great and honourable an object when the war which broke out in Germany and Italy, determined the French government to withdraw the funds granted for their voyage of discovery, and adjourn it to an indefinite period. Deeply mortified at finding the plans I had formed during many years of my life overthrown in a single day, I sought at any risk the speediest means of quitting Europe, and engaging in some enterprise which might console me for my disappointment.

I became acquainted with a Swedish consul, named Skioldebrand, who having been appointed by his court to carry presents to the dey of Algiers, was passing through Paris, to embark at Marseilles. This estimable man had resided a long time on the coast of Africa; and being highly respected by the government of Algiers, he could easily procure me permission to visit that part of the chain of the Atlas which had not been the object of the important researches of M. Desfontaines. He despatched every year a vessel for Tunis, where the pilgrims embarked for Mecca, and he promised to convey me by the same medium to Egypt. I eagerly seized so favourable an opportunity, and thought myself on the point of executing a plan which I had formed previously to my arrival in France. No mineralogist had yet examined that lofty chain of mountains which, in the empire of Morocco, rises to the limits of the perpetual snow. I flattered myself, that, after executing some operations in the alpine regions of Barbary, I should receive in Egypt from those illustrious men who had for some months formed the Institute of Cairo, the same kind attentions with which I had been honoured during my abode in Paris. I hastily completed my collection of instruments, and purchased works relating to the countries I was going to visit. I parted from a brother who, by his advice and example, had hitherto exercised a great influence on the direction of my thoughts. He approved the motives which determined me to quit Europe; a secret voice assured us that we should meet again; and that hope, which did not prove delusive, assuaged the pain of a long separation. I left Paris with the intention
of embarking for Algiers and Egypt; but by one of those vicissitudes which sway the affairs of this life, I returned to my brother from the river Amazon and Peru, without having touched the continent of Africa.

The Swedish frigate which was to convey M. Skioldebrand to Algiers, was expected at Marseilles toward the end of October. M. Bonpland and myself repaired thither with great celerity, for during our journey we were tormented with the fear of being too late, and missing our passage.
M. Skioldebrand was no less impatient than ourselves to reach his place of destination. Several times a day we climbed the mountain of Notre Dame de la Garde, which commands an extensive view of the Mediterranean." Every sail we descried in the horizon excited in us the most eager emotion; but after two months of anxiety and vain expectation, we learned by the public papers, that the Swedish frigate which was to convey us, had suffered greatly in a storm on the coast of Portugal, and had been forced to enter the port of Cadiz, to refit. This news was confirmed by private letters, assuring us that the Jaramas, which was the name of the frigate, would not reach Marseilles before the spring.

We felt no inclination to prolong our stay in Provence till that period. The country, and especially the climate, were delightful, but the aspect of the sea reminded us of the failure of our projects. In an excursion we made to Hyères and Toulon, we found in the latter port the frigate la Boudeuse, which had been commanded by M. de Bougainville, in his voyage round the world. She was then fitting out for Corsica. M. de Bougainville had honoured me with particular kindness during my stay in Paris, when I was preparing to accompany the expedition of captain Baudin. I cannot describe the impression made upon my mind by the sight of the vessel which had carried Commerson to the islands of the South Sea. In some conditions of the mind, a painful emotion blends itself with all our feelings.

We still persisted in the intention of visiting the African coast, and were nearly becoming the victims of our perseverance. A small vessel of Ragusa, on the point of setting sail for Tunis, was at that time in the port of Marseilles; we thought the opportunity favourable for reaching Egypt and

Syria, and we agreed with the captain for our passage. The vessel was to sail the following day; but a circumstance trivial in itself happily prevented our departure. The live-stock intended to serve us for food during our passage, was kept in the great cabin. We desired that some changes should be made, which were indispensable for the safety of our instruments; and during this interval we learnt at Marseilles, that the government of Tunis persecuted the French residing in Barbary, and that every person coming from a French port was thrown into a dungeon. Having escaped this imminent danger, we were compelled to suspend the execution of our projects. We resolved to pass the winter in Spain, in hopes of embarking the next spring, either at Carthagena, or at Cadiz, if the political situation of the East permitted.

We crossed Catalonia and the kingdom of Valencia, on our way to Madrid. We visited the ruins of Tarragona and those of ancient Saguntum; and from Barcelona we made an excursion to Montserrat, the lofty peaks of which are inhabited by hermits, and where the contrast between luxuriant vegetation and masses of naked and arid rocks, forms a landscape of a peculiar character. I employed myself in ascertaining by astronomical observations the position of several points important for the geography of Spain, and determined by means of the barometer the height of the central plain. I likewise made several observations on the inclination of the needle, and on the intensity of the magnetic forces.

On my arrival at Madrid I had reason to congratulate myself on the resolution I had formed of visiting the Peninsula. Baron de Forell, minister from the court of Saxony, treated me with a degree of kindness, of which I soon felt the value. He was well versed in mineralogy, and was full of zeal for every undertaking that promoted the progress of knowledge. He observed to me, that under the administration of an enlightened minister, Don Mariano Luis de Urquijo, I might hope to obtain permission to visit, at my own expense, the interior of Spanish America. After the disappointments I had suffered, I did not hesitate a moment to adopt this idea.

I was presented at the court of Aranjuez in March 1799,
and the king received me graciously. I explained to him the motives which led me to undertake a voyage to the new world and the Philippine Islands, and I presented a memoir on the subject to the secretary of state. Señor de Urquijo supported my demand, and overcame every obstacle. 1 obtained two passports, one from the first secretary of state, the other from the council of the Indies. Never had so extensive a permission been granted to any traveller, and never had any foreigner been honoured with more confidence on the part of the Spanish government.

Many considerations might have induced us to prolong our abode in Spain. The abbé Cavanilles, no less remarkable for the variety of his attainments than his acute intelligence; M. Nee, who, together with M. Hænke, had, as botanist, made part of the expedition of Malaspina, and who had formed one of the greatest herbals ever seen in Europe; Don Casimir Ortega, the abbé Pourret, and the learned authors of the Flora of Peru, Messrs. Ruiz and Pavon, all opened to us without reserve their rich collections. We examized part of the plants of Mexico, discovered by Messrs. Sesse, Mocino, and Cervantes, whose drawings had been sent to the Museum of Natural History of Madrid. This great establishment, the direction of which was confided to Señor Clavijo, author of an elegant translation of the works of Buffon, offered us, it is true, no geological representation of the Cordilleras, but M. Proust, so well known by the great accuracy of his chemical labours, and a distinguished mineralogist, M. Hergen, gave us curious details on several mineral substances of America. It would have been useful to us to have employed a longer time in studying the productions of the countries which were to be the objects of our research, but our impatience to take advantage of the permission given us by the court was too great to suffer us to delay our departure. For a year past, I had experienced so many disappointments, that I could scarcely persuade myself that my most ardent wishes would be at length fulfilled.

We left Madrid about the middle of May, crossed a part of Old Castile, the kingdoms of Leon and Galicia, and reached Corunna, whence we were to embark for Cuba. The winter having been protracted and severe, we enjoyed
during the journey that mild temperature of the spring, which in so southern a latitude usually occurs during March and April. The snow still covered the lofty granitic tops of the Guadarama; but in the deep vallies of Galicia, which resemble the most picturesque spots of Switzerland and the Tyrol, cistuses loaded with flowers ; and arborescent heaths clothed every rock. We quitted without regret the elevated plain of the two Castiles, which is everywhere devoid of vegetation, and where the severity of the winter's cold is followed by the overwhelming heat of summer. From the few observations I personally made, the interior of Spain forms a vast plain, elevated three hundred toises (five hundred and eighty-four metres) above the level of the ocean, is covered with secondary formations, grit-stone, gypsum, sal-gem, and the calcareous stone of Jura. The climate of the Castiles is much colder than that of Toulon and Genoa; its mean temperature scarcely rises to $15^{\circ}$ of the centigrade thermometer.

We are astonished to find that, in the latitude of Calabria, Thessaly, and Asia Minor, orange-trees do not flourish in the open air. The central elevated plain is encircled by a low and narrow zone, where the chamærops, the date-tree, the sugar-cane, the banana, and a number of plants common to Spain and the north of Africa, vegetate on several spots, without suffering from the rigours of winter. From the 36th to 40th degrees of latitude, the medium temperature of this zone is from 17 to 20 degrees; and by a concurrence of circumstances, which it would be too long to explain, this favoured region has become the principal seat of industry and intellectual improvement.

When, in the kingdom of Valencia, we ascend from the shore of the Mediterranean towards the lofty plains of La Mancha and the Castiles, we seem to discern, far inland, from the lengthened declivities, the ancient coast of the Peninsula. This curious phenomenon recalls the traditions of the Samothracians, and other historical testimonies, according to which it is supposed that the irruption of the waters through the Dardanelles, augmenting the basin of the Mediterranean, rent and overflowed the southern part of Europe. If we admit that these traditions owe their origin, not to mere geological reveries, but to the remembrance of some ancient catastrophe,
we may conceive the central elevated plain of Spain resisting the efforts of these great inundations, till the draining of the waters, by the straits formed between the pillars of Hercules, brought the Mediterranean progressively to its present level, lower Egypt emerging above its surface on the one side, and the fertile plains of Tarragona, Valencia, and Murcia, on the other. Everything that relates to the formation of that sea,* which has had so powerful an influence on the first civilization of mankind, is highly interesting. We might suppose, that Spain, forming a promontory amidst the waves, was indebted for its preservation to the height of its land; but in order to give weight to these theoretic ideas, we must clear up the doubts that have arisen respecting the rupture of so many transverse dikes;-we must discuss the probability of the Mediterranean having been formerly divided into several separate basins, of which Sicily and the island of Candia appear to mark the ancient limits. We will not here risk the solution of these problems, but will satisfy ourselves in fixing attention on the striking contrast in the configuration of the land in the eastern and western extremities of Europe. Between the Baltic and the Black Sea, the ground is at present scarcely fifty toises above the level of the ocean, while the plain of La Mancha, if placed between the sources of the Niemen and the Borysthenes, would figure as a group of mountains of considerable height. If the causes, which may have changed the surface of our planet, be an interesting speculation, investigations of the phenomena, such as they offer themselves to the measures and observations of the naturalist, lead to far greater certainty.

From Astorga to Corunna, especially from Lugo, the

[^1]mountains rise gradually. The secondary formations gently disappear, and are succeeded by the transition rocks, which indicate the proximity of primitive strata. We found considerable mountains composed of that ancient gray stone which the mineralogists of the school of Freyberg name granwakke, and grauwakkenschiefer. I do not know whether this formation, which is not frequent in the south of Europe, has hitherto been discovered in other parts of Spain. Angular fragments of Lydian stone, scattered along the vallies, seemed to indicate that the transition schist is the basis of the strata of graywacke. Near Corunna even granitic ridges stretch as far as Cape Ortegal. These granites, which seem formerly to have been contiguous to those of Britanny and Cornwall, are perhaps the wrecks of a chain of mountains destroyed and sunk in the waves. Large and beautiful crystals of feldspar characterise this rock. Common tin ore is sometimes discovered there, but working the mines is a laborious and unprofitable operation for the inhabitants of Galicia.

The first secretary of state had recommended us very particularly to brigadier Don Raphael Clarijo, who was employed in forming new dock-yards at Corunna.' He advised as to embark on board the sloop Pizarro,* which was to sail in company with the Alcudia, the packet-boat of the month of May, which, on account of the blockade, had been detained three weeks in the port. Señor Clavijo ordered the necessary arrangements to be made on board the sloop for placing our instruments, and the captain of the Pizarro received orders to stop at Teneriffe, as long as we should judge necessary to enable us to visit the port of Orotava, and ascend the peak.

We had yet ten days to wait before we embarked. During this interval, we employed ourselves in preparing the plants we had collected in the beautiful vallies of Galicia, which no naturalist had yet visited: we examined the fuci and the mollusce which the north-west winds had cast with great profusion at the foot of the steep rock, on which the lighthouse of the Tower of Hercules is built. This edifice, called also the Iron Tower, was repaired in 1788. It is ninety-two feet high, its walls are four feet and a half thick, and its construction clearly proves that it was built by the Romans. An

* According to the Spanish nomenclature, the Pizarro was a light frigate (fragata lijera).
inscription discovered near its foundation, a copy of which M. Laborde obligingly gave me, informs us, that this pharos was constructed by Caius Sevius Lupus, architect of the city of Aqua Flavia (Chaves), and that it was dedicated to Mars. Why is the Iron Tower called in the country by the name of Hercules? Was it built by the Romans on the ruins of a Greek or Phomnician edifice? Strabo, indeed, affirms that Galicia, the country of the Callæci, had been peopled by Greek colonies. According to an extract from the geography of Spain, by Asclepiades the Myrlæan, an ancient tradition stated that the companions of Hercules had settled in these countries.

The ports of Ferrol and Corunna both communicate with one bay, so that a vessel driven by bad weather towards the coast may anchor in either, according to the wind. This advantage is invaluable where the sea is almost always tempestuous, as between capes Ortegal and Finisterre, which are the promontories Trileucum and Artabrum of ancient geography. A narrow passage, flanked by perpendicular rocks of granite, leads to the extensive basin of Ferrol. No port in Europe has so extraordinary an anchorage, from its very inland position. The narrow and tortuous passage by which vessels enter this port, has been opened, either by the irruption of the waves, or by the reiterated shocks of very violent earthquakes. In the New World, on the coasts of New Andalusia, the Laguna del Obispo (Bishop's lake) is formed exactly like the port of Ferrol. The most curious geological phenomena are often repeated at immense distances on the surface of continents; and naturalists who have examined different parts of the globe, are struck with the extreme resemblance observed in the rents on coasts, in the sinuosities of the vallies, in the aspect of the mountains, and in their distribution by groups. The accidental coneurrence of the same causes must have everywhere produced the same effects; and amidst the variety of nature, an analogy of structure and form is observed in the arrangement of inanimate matter, as well as in the internal organization of plants and of animals.

Crossing from Corunna to Ferrol, over a shallow, near the White Signal, in the bay, which according to D'Anville is the Portus Magnus of the ancients, we made several experi-
ments by means of a valved thermometrical sounding lead, on the temperature of the ocean, and on the decrement of caloric in the successive strata of water. The thermometer on the bank, and near the surface, was from $12.5^{\circ}$ to $13.3^{\circ}$ centigrades, while in deep water it constantly marked $15^{\circ}$ or $15 \cdot 3^{\circ}$, the air being at $12 \cdot 8^{\circ}$. The celebrated Franklin and Mr. Jonathan Williams* were the first to invite the attention of naturalists to the phenomena of the temperature of the Atlantic over shoals, and in that zone of tepid and flowing waters which runs from the gulf of Mexico to the banks of Newfoundland and the northern coasts of Europe. The observation, that the proximity of a sand-bank is indicated by a rapid descent of the temperature of the sea at its surface, is not only interesting to the naturalist, but may become also very important for the safety of navigators. The use of the thermometer ought certainly not to lead us to neglect the use of the lead; but experiments sufficiently prove, that variations of temperature, sensible to the most imperfect instruments, indicate danger long before the vessel reaches the shoals. In such cases, the frigidity of the water may induce the pilot to heave the lead in places where he thought himself in the most perfect safety. The waters which cover the shoals owe in a great measure the diminution of their temperature to their mixture with the lower strata of water, which rise towards the surface on the edge of the banks.

The moment of leaving Europe for the first time is attended with a solemn feeling. We in vain summon to our minds the frequency of the communication between the two worlds; we in vain reflect on the great facility with which, from the improved state of navigation, we traverse the Atlantic, which compared to the Pacific is but a larger arm of the sea; the sentiment we feel when we first undertake so distant a voyage is not the less accompanied by a deep emotion, unlike any other impression we have hitherto felt. Separated from the objects of our dearest affections, entering in some sort on a new state of existence, we are forced to fall back on our own thoughts, and we feel within ourselves a dreariness we have never known before. Among the letters which, at the time of our embarking, I wrote to friends in

* Author of a work entitled "Thermometrical Navigation," published at Philadelphia.

France and Germany, one had a considerable influence on the direction of our travels, and on our succeeding operations. When I left Paris with the intention of visiting the coast of Africa, the expedition for discoveries in the Pacific seemed to be adjourned for several years. I had agreed with captain Baudin, that if, contrary to his expectation, his voyage took place at an earlier period, and intelligence of it should reach me in time, I would endeavour to return from Algiers to a port in France or Spain, to join the expedition. I renewed this promise on leaving Europe, and wrote to M. Baudin, that if the government persisted in sending him by Cape Horn, I would endeavour to meet him either at Monte Video, Chile, or Lima, or wherever he should touch in the Spanish colonies. In consequence of this engagement, I changed the plan of my journey, on reading in the American papers, in 1801, that the French expedition had sailed from Havre, to circumnarigate the globe from east to west. I hired a small vessel from Batabano, in the island of Cuba, to Portobello, and thence crossed the isthmus to the coast of the Pacific; this mistake of a journalist led M. Bonpland and myself to travel eight hundred leagues through a country we had no intention to visit. It was only at Quito, that a letter from M. Delambre, perpetual secretary of the first class of the Institute, informed us, that captain Baudin went by the Cape of Good Hope, without touching on the eastern or western coasts of America.

We spent two days at Corunna, after our instruments were embarked. A thick fog, which covered the horizon, at length indicated the change of weather we so anxiously desired. On the 4th of June, in the evening, the wind turned to north-east, a point which, on the coast of Galicia, is considered very constant during the summer. The Pizarro prepared to sail on the 5th, though we had intelligence that only a few hours previously an English squadron had been seen from the watch-tower of Sisarga, appearing to stand towards the mouth of the Tagus. Those who saw our ship weigh anchor asserted that we should be captured in three days, and that, forced to follow the fate of the vessel, we should be carried to Lisbon. This prognestic gave us the more uneasiness, as we had known some Mexicans at Madrid, who, in order to return to Vera Cruz had embarked three times
at Cadiz, and having been each time taken at the entrance of the port, were at length obliged to return to Spain through Portugal.

The Pizarro set sail at two in the afternoon. As the long and narrow passage by which a ship sails from the port of Corunna opens towards the north, and the wind was contrary, we made eight short tacks, three of which were useless. A fresh tack was made, but very slowly, and we were for some moments in danger at the foot of fort St. Amarro, the current having driven us very near the rock, on which the sea breaks with considerable violence. We remained with our eyes fixed on the castle of St. Antonio, where the unfortunate Malaspina was then a captive in a state prison. On the point of leaving Europe to visit the countries which this illustrious traveller had visited with so much advantage, I could have wished to have fixed my thoughts on some object less affecting.

At half-past six we passed the Tower of Hercules, which is the lighthouse of Corunna, as already mentioned, and where, from a very remote time, a coal-fire has been kept up for the direction of vessels. The light of this fire is in no way proportionate to the noble construction of so vast an edifice, being so feeble that ships cannot perceive it till they are in danger of striking on the shore. Towards the close of day the wind increased and the sea ran high. We directed our course to north-west, in order to avoid the English frigates, which we supposed were cruizing off these coasts. About nine we spied the light of a fishing-hut at Sisarga, which was the last object we beheld in the west of Europe.

On the 7th we were in the latitude of Cape Finisterre. The group of granitic rocks, which forms part of this promontory, like that of Toriañes and Monte de Corcubion, bears the name of the Sierra de Toriñona. Cape Finisterre is lower than the neighbouring lands, but the Toriñona is visible at seventeen leagues' distance, which proves that the eleration of its highest summit is not less than 300 toises ( 582 metres). Spanish navigators affirm that on these coasts the magnetic variation differs extremely from that observed at sea. M. Bory, it is true, in the voyage of the sloop Amaranth, found in 1751, that the variation of the
needle determined at the Cape was four degrees less than could have been conjectured from the observations made at the same period along the coasts. In the same manner as the granite of Galicia contains tin disseminated in its mass, that of Cape Finisterre probably contains micaceous iron. In the mountains of the Upper Palatinate there are granitic rocks in which crystals of micaceous iron take the place of common mica.

On the 8th, at sunset, we descried from the mast-head an English convoy sailing along the coast, and steering towards south-east. In order to avoid it we altered our course during the night. From this moment no light was perriitted in the great cabin, to prevent our being seen at a distance. This precaution, which was at the time prescribed in the regulations of the packet-ships of the Spanish navy, was extremely irksome to us during the voyages we made in the course of the five following years. We were constantly obliged to make use of dark-lanterns to examine the temperature of the water, or to read the divisions on the limb of the astronomical instruments. In the torrid zone, where twilight lasts but a few minutes, our operations ceased almost at six in the evening. This state of things was so much the more vexatious to me as from the nature of my constitution I never was subject to sea-sickness, and feel an extreme ardour for study during the whole time I am at sea.

On the 9th of June, in latitude $39^{\circ} 50^{\prime}$, and longitude $16^{\circ} 10^{\prime}$ west of the meridian of the observatory of Paris, we began to feel the effects of the great current which from the Azores flows towards the straits of Gibraltar and the Canary Islands. This current is commonly attributed to that tendency towards the east, which the straits of Gibraltar give to the waters of the Atlantic Ocean. M. de Fleurieu observes that the Mediterranean, losing by evaporation more water than the rivers can supply, causes a movement in the neighbouring ocean, and that the influence of the straits is felt at the distance of six hundred leagues. Without derogating from the respect I entertain for the opinion of that celebrated navigator, I may be permitted to consider this important object in a far more general point of view.

When we cast our eyes over the Atlantic, or that deep valley which divides the western coasts of Europe and A frica from the eastern coasts of the new world, we distinguish
a contrary direction in the motion of the waters. Within the tropics, especially from the coast of Senegal to the Caribbean Sea, the general current, that which was earliest known to mariners, flows constantly from east to west. This is called the equinoctial current. Its mean rapidity, corresponding to different latitudes, is nearly the same in the Atlantic and in the Pacific, and may be estimated at nine or ten miles in twenty-four hours, consequently from 0.59 to 0.65 of a foot every second! In those latitudes the waters run towards the west with a velocity equal to a fourth of the rapidity of the greater part of the larger rivers of Europe. The movement of the ocean in a direction contrary to that of the rotation of the globe, is probably connected with this last phenomenon only as far as the rotation converts into trade winds* the polar winds, which, in the low regions of the atmosphere bring back the cold air of the high latitudes toward the equator. To the general impulsion which these trade-winds give the surface of the sea, we must attribute the equinoctial current, the force and rapidity of which are not sensibly modified by the local variations of the atmosphere.

In the channel which the Atlantic has dug between Guiana and Guinea, on the meridian of 20 or 23 degrees, and from the 8 th or 9 th to the 2 nd or 3 rd degrees of northern latitude, where the trade-winds are often interrupted by winds blowing from the south and south-south-west, the equinoctial current is more inconstant in its direction. Towards the coasts of Africa, vessels are drawn in the direction of south-east; whilst towards the Bay of All Saints and Cape St. Augustin, the coasts of which are dreaded by navigators sailing towards the mouth of the Plata, the general motion of the waters is masked by a particular current (the effects of which extend from Cape St. Roche to the Isle of Trinidad) running north-west with a mean velocity of a foot and a half every second.

The equinoctial current is felt, though feebly, even beyond the tropic of Cancer, in the 26th and 28th degrees of latitude. In the vast basin of the Atlantic, at six or seven hundred leagues from the coasts of Africa, vessels from Europe bound to the West Indies, find their sailing accele-

[^2]rated before they reach the torrid zone. More to the north, in 28 and 35 degrees, between the parallels of Teneriffe and Ceuta, in 46 and 48 degrees of longitude, no constant motion is observed: there, a zone of 140 leagues in breadth separates the equinoctial current (the tendency of which is towards the west) from that great mass of water which runs eastward, and is distinguished for its extraordinary high temperature. To this mass of waters, known by the name of the Gulf-stream,* the attention of naturalists was directed in 1776 by the curious observations of Franklin and Sir Charles Blagden.

The equinoctial current drives the waters of the Atlantic towards the coasts inhabited by the Mosquito Indians, and towards the shores of Honduras. The New Continent, stretching from south to north, forms a sort of dyke to this current. The waters are carried at first north-west, and passing into the Gulf of Mexico through the strait formed by Cape Catoche and Cape St. Antonio, follow the bendings of the Mexican coast, from Vera Cruz to the mouth of the Rio del Norte, and thence to the mouths of the Mississippi, and the shoals west of the southern extremity of Florida. Having made this vast circuit west, north, east, and south, the current takes a new direction northward, and throws itself with impetuosity into the Gulf of Florida. At the end of the Gulf of Florida, in the parallel of Cape Cannaveral, the Gulf-stream, or current of Florida, runs north-east. Its rapidity resembles that of a torrent, and is sometimes five miles an hour. The pilot may judge, with some certainty, of the proximity of his approach to New York, Philadelphia, or Charlestown when he reaches the edge of the stream ; for the elevated temperature of the waters, their saltness, indigo-blue colour, and the shoals of seaweed which cover their surface, as well as the heat of the surrounding atmosphere, all indicate the Gulf-stream. Its rapidity diminishes towards the north, at the same time that its breadth increases and the waters become cool. Between Cayo Biscaino and the bank of Bahama the breadth is only 15 leagues, whilst in the latitude of $28 \frac{1}{2}$ degrees, it is 17 , and in the parallel of Charlestown, opposite Cape Henlopen, from 40

* Sir Francis Drake observed this extraordinary movement of the waters, but he was unacquainted with their high temperature.

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to 50 leagues. The rapidity of the current is from three to five miles an hour where the stream is narrowest, and is only one mile as it advances towards the north. The waters of the Mexican Gulf, forcibly drawn to north-east, preserve their warm temperature to such a point, that in 40 and 41 degrees of latitude I found them at $22.5^{\circ}$ ( $18^{\circ}$ R.) when, out of the current, the heat of the ocean at its surface was scarcely $17.5^{\circ}$ ( $14^{\circ}$ R.). In the parallel of New York and Oporto, the temperature of the Gulf-stream is consequently equal to that of the seas of the tropics in the 18th degree of latitude, as, for instance, in the parallel of Porta Rico and the islands of Cape Verd.

To the east of the port of Boston, and on the meridian of Halifax, in latitude $41^{\circ} 25^{\prime}$, and longitude $67^{\circ}$, the current is near 80 leagues broad. From this point it turns suddenly to the east, so that its western edge, as it bends, becomes the western limit of the running waters, skirting the extremity of the great bank of Newfoundland, which M. Volney ingeniously calls the bar of the mouth of this cmormous sea-river. The cold waters of this bank, whieh according to my experiments are at a temperature of $8.7^{\circ}$ or $10^{\circ}$ ( $7^{\circ}$ or $8^{\circ}$ h.) present a striking contrast with the waters of the torrid zone, driven northward by the Gulf-stream, the temperature of which is from $21^{\circ}$ to $22.5^{\circ}\left(17^{\circ}\right.$ to $18^{\circ} \mathrm{R}$.). In these latitudes, the caloric is distributed in a singular manner throughout the ocean; the waters of the bank are. $9 \cdot 4^{\circ}$ colder than the neighbouring sea; and this sea is $3^{\circ}$ colder than the current. These zones can have no equilibrium of temperature, having a source of heat, or a cause. of refrigeration, which is peculiar to each, and the influence of which is permament.

From the bank of Newfoundland, or from the 52nd degree of longitude to the Azores, the Gulf-stream continues its course to east and east-south-east. The waters are still acted upon by the impulsion they received near a thousand leagues distance, in the straits of Florida, between the island of Cuba and the shoals of Tortoise Island. This distance is double the length of the course of the river Amazon, from Jaen or the straits of Manseriche to Grand Para. On the meridian of the islands of Corvo and Flores, the most western of the group of the Azores, the breadth of the cument is.

160 leagues. When vessels, on their return from South America to Europe, endeavour to make these two islands to rectify their longitude, they are always sensible of the motion of the waters to south-east. At the 33 rd degree of latitude the equinoctial current of the tropics is in the near vicinity of the Gulf-stream. In this part of the ocean, we may in a single day pass from waters that flow towards the west, into those which run to the south-east or east-southeast.

From the Azores, the current of Florida turns towards the straits of Gibraltar, the isle of Madeira, and the group of the Canary Islands. The opening of the Pillars of Hercules has no doubt accelerated the motion of the waters towards the east. We may in this point of view assert, that the strait, by which the Mediterranean communicates with the Atlantic, produces its effects at a great distance; but it is probable also, that, without the existence of this strait, vessels sailing to Teneriffe would be driven southeast by a cause which we must seek on the coasts of the New World. Every motion is the cause of another motion in the vest basin of the seas as well as in the aerial ocean. Tram cing the currents to their most distant sources, and reflecting on their variable celerity, sometimes decreasing as between the gulf of Florida and the bank of Newfoundland; at other times augmenting, as in the neighbourhood of the straits of Gibraltar, and near the Canary Islands, we cannot doubt but the same cause which impels the waters to make the circuitous sweep of the gulf of Mexico, agitates them also near the island of Madeira.

On the south of that island, we may follow the current, in its direction S.E. and S.S.E. towards the coast of Africa, between Cape Cantin and Cape Bojador. In those latitudes a vessel becalmed is running on the coast, while, according to the uncorrected reckoning, it was supposed to be a good distance out at sea. Were the motion of the waters caused by the opening at the straits of Gibraltar, why, on the south of those straits, should it not follow an opposite direction? On the contrary, in the 25th and 26th degrees of latitude, the current flows at first direct south, and then south-west. Cape Blanc, which, after Cape Verd, is the most salient promontory, seems to have an influence
on this direction, and in this parallel the waters, of which we have followed the course from the coasts of Honduras to those of Africa, mingle with the great current of the tropics to resume their tour from east to west. Several hundred leagues westward of the Canary Islands, the motion peculiar to the equinoctial waters is felt in the temperate zone from the 28th and 29th degrees of north latitude; but on the meridian of the island of Ferro, vessels sail southward as far as the tropic of Cancer, before they find themselves, by their reckoning, eastward of their right course.*

We have just seen that between the parallels of 11 and 43 degrees, the waters of the Atlantic are driven by the currents in a continual whirlpool. Supposing that a molecule of water returns to the same place from which it departed, we can estimate, from our present knowledge of the swiftness of currents, than this circuit of 3800 leagues is not terminated in less than two years and ten months. A boat, which may be supposed to receive no impulsion from the winds, would require thirteen months to go from the Canary Islands to the coast of Caracas, ten months to make the tour of the gulf of Mexico and reach Tortoise Shoals opposite the port of the Havannah, while forty or fifty days might be sufficient to carry it from the straits of Florida to the bank of Newfoundland. It would be difficult to fix the rapidity of the retrograde current from this bank to the shores of Africa; estimating the mean velocity of the waters at seven or eight miles in twenty-four hours, we may allow ten or eleven months for this last distance. Such are the effects of the slow but regular motion which agitates the waters of the Atlantic. Those of the river Amazon take nearly forty-five days to flow from Tomependa to Grand Para.

A short time before my arrival at Teneriffe, the sea had left in the road of Santa Cruz the trunk of a cedrela odorata covered with the bark. This American tree vegetates within the tropics, or in the neighbouring regions. It had no doubt been torn up on the coast of the continent, or of that of Honduras. The nature of the wood, and the lichens which covered its bark, bore evidence that this trunk had not belonged to these submarine forests which * Sce Humboldt's Cosmos, vol. i., p. 312. Bohn's edition.
ancient revolutions of the globe have deposited in the polar regions. If the cedrela, instead of having been cast on the strand of Teneriffe, had been carried farther south, it would probably have made the whole tour of the Atlantic, and returned to its native soil with the general current of the tropics. This conjecture is supported by a fact of more ancient date, recorded in the history of the Canaries by the abbé Viera. In 1770, a small vessel laden with corn, and bound from the island of Lancerota, to Santa Cruz, in Teneriffe, was driven out to sea, while none of the crew were on board. The motion of the waters from east to west, carried it to America, where it went on shore at La Guayra, near Caracas.

Whilst the art of navigation was yet in its infancy, the Gulf-stream suggested to the mind of Christopher Columbus certain indications of the existence of western regions. Two corpses, the features of which indicated a race of unknown men, were cast ashore on the Azores, towards the end of the 15th century. Nearly at the same period, the brother-in-law of Columbus,.Peter Correa, governor of Porto Santo, found on the strand of that island pieces of bamboo of extraordinary size, brought thither by the western currents. The dead bodies and the bamboos attracted the attention of the Genoese navigator, who conjectured that both came from a continent situate towards the west. We now know that in the torrid zone the trade-winds and the current of the tropics are in opposition to every motion of the waves in the direction of the earth's rotation. The productions of the new world cannot reach the old but by the very high latitudes, and in following the direction of the current of Florida. The fruits of several trees of the Antilles are often washed ashore on the coasts of the islands of Ferro and Gomera. Before the discovery of America, the Canarians considered these fruits as coming from the enchanted isle of St. Borondon, which according to the reveries of pilots, and certain legends, was situated towards the west in an unknown part of the ocean, buried, as was supposed, in eternal mists.

My chief view in tracing a sketch of the currents of the Atlantic is to prove that the motion of the waters towards the south-east, from Cape St. Vincent to the Canary Islands,
is the effeet of the general motion to which the surface of the ocean is subjected at its western extremity. We shall give but a very succinct account of the arm of the Gulfstream, which in the 45th and 50th degrees of latitude, near the bank called the Bonnet Flamand, runs from south-west to north-east towards the coasts of Europe. This partial current becomes very strong at those times when the west winds are of long continuance: and, like that which flows along-the isles of Ferro and Gomera, it deposits every year on the western coasts of Ireland and Norway the fruit of trees which belong to the torrid zone of America. On the shores of the Hebrides, we collect seeds of Mimosa scandens, of Dolichos urens, of Guilandina bonduc, and several other plants of Jamaica, the isle of Cuba, and of the neighbouring continent. The current carries thither also barrels of French wine, well preserved, the remains of the cargoes of vessels wrecked in the West Indian seas. To these examples of the distant migration of the vegetable world, others no less striking may be added. The wreck of an English vessel, the Tilbury, burnt near Jamaica, was found on the coast of Scotland. On these same coasts are sometimes found various kinds of tortoises, that inhabit the waters of the Antilles. When the western winds are of long duration, a current is formed in the high latitudes, which runs directly towards east-south-east, from the coasts of Greenland and Labrador, as far as the north of Scotland. Wallace relates, that twice (in 1682 and 1684), American savages of the race of the Esquimaux, driven out to sea in their leathern canoes, during a storm, and left to the guidance of the currents, reached the Orkneys. This last example is the more worthy of attention, as it proves at the same time how, at a period when the art of navigation was yet in its infancy, the motion of the waters of the ocean may have contributed to disseminate the different races of men over the face of the globe.

In reflecting on the causes of the Atlantic currents, we find that they are much more numerous than is generally believed; for the waters of the sea may be put in motion by an external impulse, by difference of heat and saltness, by the periodical melting of the polar ice, or by the inequality of evaporation, in different latitudes. Sometimes several of these causes concur to one and the same effect, and some-
times they produce several contrary effects. Winds that are light, but which, like the trade-winds, are continually acting on the whole of a zone, cause a real movement of transition, which we do not observe in the heaviest tempests, because these last are circumscribed within a small space. When, in a great mass of water, the particles at the surface aequire a different specific gravity, a superficial current is formed, which takes its direction towards the point where the water is coldest, or where it is most saturated with muriate of soda, sulphate of lime, and muriate or sulphate of magnesia. In the seas of the tropics we find, that at great depths the thermometer marks 7 or 8 centesimal degrees. Such is the result of the numerous experiments of commedore Ellis and of M. Peron. The temperature of the air in those latitudes being never below 19 or 20 degrees, it is not at the surface that the waters can have acquired a degree of cold so near the point of congelation, and of the maximum of the density of water. The existence of this cold stratum in the low latitudes is an evident proof of the existence of an under-current, which runs from the poles towards the equator: it also proves that the saline substances which alter the specific gravity of the water, are distributed in the ocean, so as not to annihilate the effect produced by the differences of temperature.

Considering the velocity of the molecules, which, on account of the rotatory motion of the globe, vary with the parallels, we may be tempted to admit that every current, in the direction from south to north, tends at the same time eastward, while the waters which run from the pole towards the equator, have a tendency to deviate westward. We may also be led to think that these tendencies diminish to a certain point the speed of the tropical current, in the same manner as they change the direction of the polar current, which in July and August, is regularly perceived during the melting of the ice, on the parallel of the bank of Newfoundland, and farther north. Very old nautical observations, which I have had occasion to confirm by comparing the longitude given by the chronometer with that which the pilots obtained by their reckoning, are, however, contrary to these theoretical ideas. In both hemispheres, the polar currents, when they are perceived, decline a little to the
east; and it would seem that the cause of this phenomenon should be sought in the constancy of the westerly winds which prevail in the high latitudes. Besides, the particles of water do not move with the same rapidity as the particles of air; and the currents of the ocean, which we consider as most rapid, have only a swiftness of eight or nine feet a second; it is consequently very probable, that the water, in passing through different parallels, gradually acquires a velocity correspondent to those parallels, and that the rotation of the earth does not change the direction of the currents.

The variable pressure on the surface of the sea, caused by the changes in the weight of the air, is another cause of motion which deserves particular attention. It is well known, that the barometric variations do not in general take place at the same moment in two distant points, which are on the same level. If in one of these points the barometer stands a few lines lower than in the other, the water will rise where it finds the least pressure of air, and this local intumescence will continue, till, from the effect of the wind, the equilibrium of the air is restored. M. Vaucher thinks that the tides in the lake of Geneva, known by the name of the seiches, arise from the same cause. We know not whether it be the same, when the movement of progression, which must not be confounded with the oscillation of the waves, is the effect of an external impulse. M. de Fleurieu, in his narrative of the voyage of the Isis, cites several facts, which render it probable that the sea is not so still at the bottom as naturalists generally suppose. Without entering here into a discussion of this question, we shall only observe that, if the external impulse is constant in its action, like that of the trade-winds, the friction of the particles of water on each other must necessarilly propagate the motion of the surface of the ocean even to the lower strata; and in fact this propagation in the Gulf-stream has long been admitted by navigators, who think they discover the effects in the great depth of the sea wherever it is traversed by the current of Florida, even amidst the sand-banks which surround the northern coasts of the United States. This immense river of hot waters, after a course of fifty days, from the 24th to the 45 th degree of latitude, or 450 leagues, does not lose,
amidst the rigours of winter in the temperate zone, more than 3 or 4 degrees of the temperature it had under the tropics. The greatness of the mass, and the small conductibility of water for heat, prevent a more speedy refrigeration. If, therefore, the Gulf-stream has dug a channel at the bottom of the Atlantic ocean, and if its waters are in motion to considerable depths, they must also in their inferior strata keep up a lower temperature than that observed in the same parallel, in a part of the sea which has neither currents nor deep shoals. These questions can be cleared up only by direct experiments, made by thermometrical soundings.

Sir Erasmus Gower remarks, that, in the passage from England to the Canary islands, the current, which carries vessels towards the south-east, begins at the 39th degree of latitude. During our voyage from Corunna to the coast of South America, the effect of this motion of the waters was perceived farther north. From the 37 th to the 30th degree, the deviation was very unequal ; the daily average effect was 12 miles, that is, our sloop drove towards the east 75 miles in six days. In crossing the parallel of the straits of Gibraltar, at a distance of 140 leagues, we had occasion to observe, that in those latitudes the maximum of the rapidity does not correspond with the mouth of the straits, but with a more northerly point, which lies on the prolongation of a line passing through the strait and Cape St. Vincent. This line is parallel to the direction which the waters follow from the Azores to Cape Cantin. We should moreover observe (and this fact is not uninteresting to those who examine the nature of fluids), that in this part of the retrograde curreut, on a breadth of 120 or 140 leagues, the whole mass of water has not the same rapidity, nor does it follow precisely the same direction. When the sea is perfectly calm, there appears at the surface narrow stripes, like small rivulets, in which the waters run with a murmur very sensible to the ear of an experienced pilot. On the 13th of June, in $34^{\circ} 36^{\prime}$ north latitude, we found ourselves in the midst of a great number of these beds of currents. We took their direction with the compass; and some ran northeast, others east-north-east, though the general movement of the ocean, mdicated by comparing the reckoning with the chronometrical longitude, continued to be south-east. It
is very common to see a mass of motionless waters crossed by threads of water, which run in different directions, and we may daily observe this phenomenon on the surface of lakes; but it is much less frequent to find partial movements, impressed by local causes on small portions of waters in the midst of an oceanic river, which oceupies an immense space, and which moves, though slowly, in a constant direction. In the conflict of currents, as in the oscillation of the waves, our imagination is struck by those movements which seem to penetrate each other, and by which the ocean is continually agitated.

We passed Cape St. Vincent, which is of basaltic formation, at the distance of more than eighty leagues. It is not distinctly seen at a greater distance than 15 leagues, but the granitic mountain called the Foya de Monchique, situated near the Cape, is perceptible, as pilots allege, at the distance of 26 leagues. If this assertion be exact, the Foya is 700 toises ( 1363 metres), and consequently 116 toises ( 225 metres) higher than Vesuvius.

From Corunna to the 36th degree of latitude we had scarcely seen any organic being, excepting sea-swallows and a few dolphins. We looked in vain for sea-weeds (fuci) and mollusca, when on the 11th of June we were struck with a curious sight which afterwards was frequently renewed in the southern ocean. We entered on a zone where the whole sea was covered with a prodigious quantity of medusas. The vessel was almost becalmed, but the mollusca were borne towards the south-east, with a rapidity four times greater than the current. Their passage lasted near three quarters of an hour. We then perceived but a few scattered individuals, following the crowd at a distance as if tired with their journey. Do these animals come from the bottom of the sea, which is perhaps in these latitudes some thousand fathoms deep? or do they make distant voyages in shoals? We know that the mollusca haunt banks; and if the eight rocks, near the surface, which captain Vobonne mentions having seen in 1732, to the north of Porto Santo, really exist, we may suppose that this innumerable quantity of medusas had been thence detached; for we were but 28 leagues from the reef. We found, beside the Medusa aurita of Baster, and the Medusa pelagica of

Bose with eight tentacula (Pelagia denticulata, Péron), a third species which resembles the Medusa hysocella, and which Vandelli found at the mouth of the Tagus. It is known by its brownish-yellow colour, and by its tentacula, which are longer than the body. Several of these sea-nettles were four inches in diameter: their reflection was almost metallic : their changeable colours of violet and purple formed an agreeable contrast with the azure tint of the осеап.
In the midst of these medusas M. Bonpland abserved bundles of Dagysa notata, a mollusca of a singular construction, which Sir Joseph Banks first discovered. These are small gelatinous bags, transparent, cylindrical, sometimes polygonal, thirteen lines long and two or three in diameter. These bags are open at both ends. In one of these openings, we observed a hyaline bladder, marked with a yellow spot. The cylinders lie longitudinally, one against another, like the cells of a bee-hive, and form chaplets from six to eight inches in length. I tried the galvanic electricity on these mollusca, but it produced no contraction. It appears that the genus dagysa, formed at the time of Cook's first voyage, belongs to the salpas (biphores of Bruguière), to which M. Cuvier joins the Thalia of Brown, and the Tethys ragina of Tilesius. The salpas journey also by groups, joining in chaplets, as we have observed of the dagysa.
On the morning of the 13th of June, in $34^{\circ} 33^{\prime}$ latitude, we saw large masses of this last mollusca in its passage, the sea being perfectly calm. We observed during the night, that, of three species of medusas which we collected, none yielded any light but at the moment of a very slight shock. This property does not belong exclusively to the Medusa noctiluca, which Forskæl has described in his Fauna Egyptiaca, and which Gmelin has applied to the Medusa pelagica of Lefling, notwithstanding its red tentacula, and the brownish tuberosities of its body. If we place a very irritable medusa on a pewter plate, and strike against the plate with any sort of metal, the slight vibrations of the plate are sufficient to make this animal emit light. Sometimes, in galvanising the medusa, the phosphorescence appears at the moment that the chain closes, though the exciters are not in immediate contact with the organs of the animal. The fingers with
which we touch it remain luminous for two or three minutes, as is observed in breaking the shell of the pholades. If we rub wood with the body of a medusa, and the part rubbed ceases shining, the phosphorescence returns if we pass a dry hand over the wood. When the light is extinguished a second time, it can no longer be reproduced, though the place rubbed be still humid and viscous. In what manner ought we to consider the effect of the friction, or that of the shock? This is a question of difficult solution. Is it a slight augmentation of temperature which favours the phosphorescence? or does the light return, because the surface is renewed, by putting the animal parts proper to disengage the phosphoric hydrogen in contact with the oxygen of the atmospheric air? I have proved by experiments published in 1797, that the shining of wood is extinguished in hydrogen gas, and in pure azotic gas, and that its light reappears whenever we mix with it the smallest bubble of oxygen gas. These facts, to which several others may be added, tend to explain the causes of the phosphorescence of the sea, and of that peculiar influence which the shock of the waves exercises on the production of light.

When we were between the island of Madeira and the coast of Africa, we had slight breezes and dead calms, very favourable for the magnetic observations, which occupied me during this passage. We were never weary of admiring the beauty of the nights; nothing can be compared to the transparency and serenity of an African sky. We were struck with the innumerable quantity of falling stars, which appeared at every instant. The farther progress we made towards the south, the more frequent was this phenomenon, especially near the Canaries. I have observed during my travels, that these igneous meteors are in general more common and luminous in some regions of the globe than in others; but I have never beheld them so multiplied as in the vicinity of the volcanoes of the province of Quito, and in that part of the Pacific ocean which bathes the volcanic coasts of Guatimala. The influence which place, climate, and season appear to exercise on the falling stars, distinguishes this class of meteors from those to which we trace stones that drop from the sky (ä̈rolites), and which probably exist beyond the boundaries of our atmosphere. According to
the observations of Messrs. Benzenberg and Brandes, many of the falling stars seen in Europe have been only thirty thousand toises high. One was even measured which did not exceed fourteen thousand toises, or five nautical leagues, These measures, which can give no result but by approximation, deserve well to be repeated. In warm climates, especially within the tropics, falling stars leave a tail behind them, which remains luminous 12 or 15 seconds: at other times they seem to burst into sparks, and they are generally lower than those in the north of Europe. We perceive them only in a serene and azure sky; they have perhaps never been below a cloud. Falling stars often follow the same direction for several hours, which direction is that of the wind. In the bay of Naples, M. Gay-Lussac and myself observed luminous phenomena very analogous to those which fixed my attention during a long abode at Mexico and Quito. These meteors are perhaps modified by the nature of the soil and the air, like certain effects of the looming or mirage, and of the terrestial refraction peculiar to the coasts of Calabria and Sicily.

When we were forty leagues east of the island of Madeira, a swallow* perched on the topsail-yard. It was so fatigued, that it suffered itself to be easily taken. It was remarkable that a bird, in that season, and in calm weather, should fly so far. In the expedition of d'Entrecasteaux, a common swallow was seen 60 leagues distant from Cape Blanco; but this was towards the end of October, and M. Labillardière thought it had newly arrived from Europe. We crossed these latitudes in June, at a period when the seas had not for a long time been agitated by tempests. I mention this last circumstance, because small birds and even butterflies, are sometimes forced out to sea by the impetuosity of the winds, as we observed in the Pacific ocean, when we were on the western coast of Mexico.

The Pizarro had orders to touch at the isle of Lancerota, one of the seven great Canary Islands; and at five in the afternoon of the 16 th of June, that island appeared so distinctly in view that I was able to take the angle of altitude of a conic mountain, which towered majestically over the - Hirundo rustica, Linn.
other summits, and, which we thought was the great volcano which had occasioned such devastation on the night of the 1st of September, 1730.

The current drew us toward the coast more rapidly than we wished. As we advanced, we discovered at first the island of Forteventura, famous for its numerous camels;* and a short time after we saw the small island of Lobos in the channel which separates Forteventura from Lancerota. We spent part of the night on deck. The moon illumined the volcanic summits of Lancerota, the flanks of which, covered with ashes, reflected a silver light. Antares threw out its resplendent rays near the lunar disk, which was but a few degrees above the horizon. The night was beautifully serene and cool. Though we were but a little distance from the African coast, and on the limit of the torrid zone, the centigrade thermometer rose no higher than $18^{\circ}$. The phosphorescence of the ocean seemed to augment the mass of light diffused through the air. After midnight, great black clouds rising behind the volcano shrouded at intervals the moon and the beautiful constellation of the Scorpion. We beheld lights carried to and fro on shore, which were probably those of fishermen preparing for their labours. We had been occasionally employed, during our passage, in reading the old voyages of the Spaniards, and these moving lights recalled to our fancy those which Pedro Gutierrez, page of Queen Isabella, saw in the isle of Guanahani, on the memorable night of the discovery of the New World.

On the 17th, in the morning, the horizon was foggy, and the sky slightly covered with vapour. The outlines of the mountains of Lancerota appeared stronger: the humidity, increasing the transparency of the air, seemed at the same time to have brought the objects nearer our view. This phenomenon is well known to all who have made hygrome-

[^3]trical observations in places whence the chain of the Higher Alps or of the Andes is seen. We passed through the channel which divides the isle of Alegranza from Montaña Clara, taking soundings the whole way; and we examined the archipelago of small islands situated northward of Lancerota. In the midst of this archipelago, which is seldom visited by vessels bound for Teneriffe, we were singularly strack with the configuration of the coasts. We thought ourselves transported to the Euganean mountains in the Vicentin, or the banks of the Rhine near Bonn. The form of organized beings varies according to the climate, and it is that extreme variety which renders the study of the geography of plants and animals so attractive; but rocks, more ancient perhaps than the causes which have produced the difference of the climate on the globe, are the same in both hemispheres. The porphyries containing vitreous fetdspar and hornblende, the phonolite, the greenstone, the amygdaloids, and the basalt, have forms almost as invariable as simple crystallized substances. In the Canary Islands, and in the mountains of Auvergne, in the Mittelgebirge in Bohemia, in Mexico, and on the banks of the Ganges, the formation of trap is indicated by a symmetrical disposition of the mountains, by truncated cones, sometimes insulated, sometimes grouped, and by elevated plains, both extremities of which are crowned by a conical rising.

The whole western part of Lancerota, of which we had a near view, bears the appearance of a country recently convulsed by volcanic eruptions. Everything is black, parched, and stripped of vegetable mould. We distinguished, with our glasses, stratified basalt in thin and steeply-sloping strata. Several hills resembled the Monte Novo, near Naples, or those hillocks of seoria and ashes which the opening earth threw up in a single night at the foot of the volcano of Jorullo, in Mexico. In fact, the abbé Viera relates, that in 1730 , more than half the island changed its appearance. The great volcano, which we have just mentioned, and which the inhabitants call the volcano of Temanfaya, spread desolation over a most fertile and highly cultivated region : nine villages were entirely destroyed by the lavas. This catastrophe had been preceded by a tremendous earthquake, and
for several years shocks equally violent were felt. This last phenomenon is so much the more singular, as it seldom happens after an eruption, when the elastic vapours have found vent by the crater, after the ejection of the melted matter. The summit of the great volcano is a rounded hill, but not entirely conic. From the angles of altitude which I took at different distances, its absolute elevation did not appear to exceed three hundred toises. The neighbouring hills, and those of Alegranza and Isla Clara, were scarcely above one hundred or one hundred and twenty toises. We may be surprised at the small elevation of these summits, which, viewed from the sea, wear so majestic a form; but nothing is more uncertain than our judgment on the greatness of angles, which are subtended by objects close to the horizon. From illusions of this sort it arose, that before the measures of Messrs. de Churruca and Galleano, at Cape Pilar, navigators considered the mountains of the straits of Magellan, and those of Terra del Fuego, to be extremely elevated.

The island of Lancerota bore formerly the name of Titeroigotra. On the arrival of the Spaniards, its inhabitants were distinguished from the other Canarians by marks of greater civilization. Their houses were built with freestone, while the Guanches of Teneriffe dwelt in caverns. At Lancerota, a very singular custom prevailed at that time, of which we find no example except among the people of Thibet. A woman had several husbands, who alternately enjoyed the prerogatives due to the head of a family. A husband was considered as such only during a lunar revolution, and whilst his rights were exercised by others, he remained classed among the household domestics. In the fifteenth century the island of Lancerota contained two small distinct states, divided by a wall; a kind of monument which outlives national enmities, and which we find in Scotland, in China, and Peru.

We were forced by the winds to pass between the islands of Alegranza and Montaña Clara, and as none on board the sloop had sailed through this passage, we were obliged to be continually sounding. We found from twenty-five to thirtytwo fathoms. The lead brought up an organic substance of
so singular a structure that we were for a long time doubtful whether it was a zoophyte or a kind of seaweed. The stem, of a brownish colour and three inches long, has circular leaves with lobes, and indented at the edges. The colour of these leaves is a pale green, and they are membranous and streaked like those of the adiantums and Gingko biloba. Their surface is covered with stiff whitish hairs; before their opening they are concave, and enveloped one in the other. We observed no mark of spontaneous motion, no sign of irritability, not even on the application of galvanic electricity. The stem is not woody, but almost of a horny substance, like the stem of the Gorgons. Azote and phosphorus having been abundantly found in several cryptogamous plants, an appeal to chemistry would be useless to determine whether this organized substance belonged to the animal or vegetable kingdom. Its great analogy to several sea-plants, with adiantum leaves, especially the genus caulerpa of M. Lameureux, of which the Fucus proliter of Forskael is one of the numerous species, engaged us to rank it provisionally among the sea-wracks, and give it the name of Fucus vitifolius. The bristles which cover this plant are found in several other fuci.* The leaf, examined with a microscope at the instant we drew it up from the water, did not present, it is true, those conglobate glands, or those opaque points, which the parts of fructification in the genera of ulva and fucus contain; but how often do we find seaweeds in such a state that we cannot yet distinguish any trace of seeds in their transparent parenchyma.

The vine-leaved fucus presents a physiological phenomenon of the greatest interest. Fixed to a piece of madrepore, this seaweed vegetates at the bottom of the ocean, at the depth of 192 feet, notwithstanding which we found its leaves as green as those of our grasses. According to the experiments of Bouguer, light is weakened after a passage of 180 feet in the ratio of 1 to $1477 \%$. The seaweed of Alegranza consequently presents a new example of plants which vegetate in great obscurity without becoming white. Several germs, enveloped in the bulbs of the lily tribes, the embryo of the malvacea, of the rhamnoildes, of the pistacea, the viscum, and the citrus, the branches of some subterraneous plants; * Fucus lycopodioïdes, and F. hirsutus.

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in short, vegetables transported into mines, where the ambient air contains hydrogen or a great quantity of azote, become green without light. From these facts we are inclined to admit that it is not exclusively by the influence of the solar rays that this carburet of hydrogen is formed in the organs of plants, the presence of which makes the parenchyma appear of a lighter or darker green, according as the carbon predominates in the mixture.

Mr. Turner, who has so well made known the family of the seaweeds, as well as many other celebrated botanists, are of opinion that most of the fuci which we gather on the surface of the ocean, and which, from the 23 rd to the 35 th degree of latitude and 32 nd of longitude, appear to the mariner like a vast inundated meadow, grow primitively at the bottom of the ocean, and float only in their ripened state, when torn up by the motion of the waves. If this opinion be well founded, we must agree that the family of seaweeds offers formidable difficulties to naturalists, who persist in thinking that absence of light always produces whiteness; for how can we admit that so many species of ulvacea and dictyotew, with stems and green leaves, which float on the ocean, have vegetated on rocks near the surface of the water?

From some notions which the captain of the Pizarro had collected in an old Portuguese itinerary, he thought himself opposite to a small fort, situated north of Teguisa, the capital of the island of Lancerota. Mistaking a rock of basalt for a castle, he saluted it by hoisting the Spanish flag, and sent a boat with an officer to inquire of the commandant whether any English vessels were cruizing in the roads. We were not a little surprised to learn that the land which we had considered as a prolongation of the coast of Lancerota, was the small island of Graciosa, and that for several leagues there was not an inhabited place. We took advantage of the boat to survey the land, which enclosed a large bay.

The small part of the island of Graciosa which we traversed, resembles those promontories of lava seen near Naples, between Portici and Torre del Greco. The rocks are naked, with no marks of vegetation, and scarcely any of vegetable soil. A few crustaceous lichen-like variolarim, leprarix, and urceolariæ, were scattered about upon the basalts. The lavas which are not covered with volcanic ashes remain for ages
without any appearance of vegetation. On the African soil excessive heat and lengthened drought retard the growth of cryptogamous plants.
The basalts of Graciosa are not in columns, but are divided into strata ten or fifteen inches thick. These strata are inclined at an angle of 80 degrees to the north-west. The compact basalt alternates with the strata of porous basalt and marl. The rock does not contain hornblende, but great crystals of foliated olivine, which have a triple cleavage.* This substance is decomposed with great diffculty. M. Haüy considers it a variety of the pyroxene. The porous basalt, which passes into mandelstein, has oblong cavities from two to eight lines in diameter, lined with chalcedony, enclosing fragments of compact basalt. I did not remark that these cavities had the same direction, or that the porous rock lay on compact strata, as happens in the currents of lava of Etna and Vesuvius. The marl, $\dagger$ which alternates more than a hundred times with the basalts, is yellowish, friable by decomposition, very coherent in the inside, and often divided into irregular prisms, analogous to the basaltic prisms. The sun discolours their surface, as it whitens several schists, by reviving a hydro-carburetted principle, which appears to be combined with the earth. The marl of Graciosa contains a great quantity of chalk, and strongly effervesces with nitric acid, even on points where it is found in contact with the basalt. This fact is the more remarkable, as this substance does not fill the fissures of the rock, but its strata are parallel to those of the basalt; whence we may conclude that both fossils are of the same formation, and have a common origin. The phenomenon of a basaltic rock containing masses of indurated marl split into small columns, is also found in the Mittelgebirge, in Bohemia. Visiting those countries in 1792, in company with Mr. Freiesleben, we even recognized in the marl of the Stiefelberg the imprint of a plant nearly resembling the Cerastium, or the Alsine. Are these strata, contained in the trappean mountains, owing to muddy irruptions, or must we consider them as sediments of water, which alternate with volcanic deposits? This last hypothesis seems so much the less admissible, since, from the
researches of Sir James Hall on the influence of pressure in fusions, the existence of carbonic acid in substances contained in basalt presents nothing surprising. Several lavas of Vesuvius present similar phenomena. In Lombardy, between Vicenza and Albano, where the calcareous stone of the Jura contains great masses of basalt, I have seen the latter enter into effervescence with the acids wherever it touches the calcareous rock.

We had not time to reach the summit of a hill very remarkable for having its base formed of banks of clay.under strata of basalt, like a mountain in Saxony, called the Scheibenbergen Hügel, which is become celebrated on account of the disputes of volcanean and neptunean geologists. These basalts were covered with a mammiform substance, which I vainly sought on the Peak of Teneriffe, and which is known by the names of volcanic glass, glass of Muller, or hyalite: it is the transition from the opal to the chalcedony. We struck off with difficulty some fine specimens, leaving masses that were eight or ten inches square untouched. I never saw in Europe such fine hyalites as I found in the island of Graciosa, and on the rock of porphyry called el Peñol de los Baños, on the bank of the lake of Mexico.

Two kinds of sand cover the shore; one is black and basaltic, the other white and quartzose. In a place exposed to the rays of the sun, the first raised the thermometer to $51 \cdot 2^{\circ}$ ( $41^{\circ}$ R.) and the second to $40^{\circ}$ ( $32^{\circ}$ R.) The temperature of the air in the shade was $27.7^{\circ}$ or $7.5^{\circ}$. higher than that of the air over the sea. The quartzose sand contains fragments of feldspar. It is thrown back by the water, and forms, in some sort, on the surface of the rocks, small islets on which seaweed vegetates. Fragments of granite have been observed at Teneriffe; the island of Gomora, from the details furnished me by M. Broussonnet, contains a nucleus of micaceous schist:-the quartz disseminated in the sand, which we found on the shore of Graciosa, is a different substance from the lavas and the trappean porphyries so intimately connected with volcanic productions. From these facts it seems to be evident that in the Canary Islands, as well as on the Andes of Quito; in Auvergne, in Greece, and throughout the greater part of
the globe, subterraneous fires have pierced through the rocks of primitive formation. In treating hereafter of the great number of warm springs which we have seen issuing from granite, gneiss, and micaceous schist, we shall have occasion to return to this subject, which is one of the most important of the physical history of the globe.

We re-embarked at sunset, and hoisted sail, but the breeze was too feeble to permit us to continue our course to Teneriffe. The sea was calm; a reddish vapour covered the horizon, and seemed to magnify every object. In this solitude, amidst so many uninhabited islets, we enjoyed for a long time the view of rugged and wild scenery. The black mountains of Graciosa appeared like perpendicular walls five or six hundred feet high. Their shadows, thrown over the surface of the ocean, gave a gloomy aspect to the scenery. Rocks of basalt, emerging from the bosom of the waters, wore the resemblance of the ruins of some vast edifice, and carried our thoughts back to the remote period when submarine volcanoes gave birth to new islands, or rent continents asunder. Every thing which surrounded us seemed to indicate destruction and sterility; but the back-ground of the picture, the coasts of Lancerota presented a more smiling aspect. In a narrow pass between two hills, crowned with scattered tufts of trees, marks of cultivation were visible. The last rays of the sun gilded the corn ready for the sickle. Even the desert is animated wherever we can discover a trace of the industry of man.

We endeavoured to get out of this bay by the pass which separates Alegranza from Montaña Clara, and through which we had easily entered to land at the northern point of Graciosa. The wind having fallen, the currents drove us very near a rock, on which the sea broke with violence, and which is noted in the old charts under the name of Hell, or Infierno. As we examined this rock at the distance of two cables' length, we found that it was a mass of lava three or four toises high, full of cavities, and covered with scorim resembling coke. We may presume that this rock,* which

[^4]modern charts call the West Rock (Roca del Oeste), was raised by volcanic fire; and it might heretofore have been much higher; for the new island of the Azores, which rose from the sea at successive periods, in 1638 and 1719, had reached 354 feet when it totally disappeared in 1723, to the depth of 480 feet. This opinion on the origin of the basaltic mass of the Infierno is confirmed by a phenomenon, which was observed about the middle of the last century in these same latitudes. At the time of the eruption of the volcano of Temanfaya, two pyramidal hills of lithoid lava rose from the bottom of the ocean, and gradually united themselves with the island of Lancerota.

As we were prevented by the fall of the wind, and by the currents, from repassing the channel of Alegranza, we resolved on tacking during the night between the island of Clara and the West Rock. This resolution had nearly proved fatal. A calm is very dangerous near this rock, towards which the current drives with considerable force. We began to feel the effects of this current at midnight. The proximity of the stony masses, which rise perpendicularly above the water, deprived us of the little wind which blew : the sloop no longer obeyed the helm, and we dreaded striking every instant. It is difficult to conceive how a mass of basalt, insulated in the vast expanse of the ocean, can cause so considerable a motion of the waters. These phenomena, worthy the attention of naturalists, are well known to mariners; they are extremely to be dreaded in the Pacific ocean, particularly in the small archipelago of the islands of Gallipagos. The difference of temperature which exists between the fluid and the mass of rocks does not explain the direction which these currents take; and how can we admit that the water is engulfed at the base of these rocks, (which often are not of volcanic origin) and that this continual engulfing determines the particles of water to fill up the vacuum that takes place.

The wind having freshened a little towards the morning on the 18th, we succeeded in passing the channel. We drew very near the Infierno the second time, and remarked the large crevices, through which the gaseous fluids probably doubt because the Guanches considered the peak as the entrance into hell. In the same latitudes an island made its appearance in 1811.
issued, when this basaltic mass was raised. We lost sight of the small islands of Alegranza, Montaña Clara, and Graciosa, which appear never to have been inhabited by the Guanches. They are now visited only for the purpose of gathering archil, which production is, however, less sought after, since so many other lichens of the north of Europe have been found to yield materials proper for dyeing. Montaña Clara is noted for its beautiful canary-birds. The note of these birds varies with their flocks, like that of our chaffinches, which often differs in two neighbouring districts. Montaña Clara yields pasture for goats, a fact which proves that the interior of this islet is less arid than its coasts. The name of Alegranza is synonymous with the Joyous, (La Joyeuse, ) which denomination it received from the first conquerors of the Canary Islands, the two Norman barons, Jean de Béthencourt and Gadifer de Salle. This was the first point on which they landed. After remaining several days at Graciosa, a small part of which we examined, they conceived the project of taking possession of the neighbouring island of Lancerota, where they were welcomed by Guadariia, sovereign of the Guanches, with the same hospitality that Cortez found in the palace of Montezuma. The shepherd king, who had no other riches than his goats, became the victim of base treachery, like the sultan of Mexico.

We sailed along the coasts of Lancerota, of the island of Lobos, and of Forteventura. The second of these islands seems to have anciently formed part of the two others. This geological hypothesis was started in the seventeenth century by the Franciscan, Juan Galindo. That writer supposed that king Juba had named six Canary Islands only, because, in his time, three among them were contiguous. Without admitting the probability of this hypothesis, some learned geographers have imagined they recognized, in the two islands Nivaria and Ombrios, the Canaria and Capraria of the ancients.

The haziness of the horizon prevented us, during the whole of our passage from Lancerota to Teneriffe, from discovering the summit of the peak of Teyde. If the height of this volcano is 1905 toises, as the last trigonometrical measure of Borda indicates, its summit ought to be visible at a distance of 43 leagues, supposing the eye on a level
with the ocean, and a refraction equal to 0.079 of distance. It has been doubted whether the peak has ever been seen from the channel which separates Lancerota from Forteventura, and which is distant from the volcano, according to the chart of Varela, $2^{\circ} 29^{\prime}$, or nearly 50 leagues. This phenomenon appears nevertheless to have been verified by several officers of the Spanish navy. I had in my hand, on board the Pizarro, a journal, in which it was noted, that the peak of Teneriffe had been seen at 135 miles distance, near the southern cape of Lancerota, called Pichiguera. Its summit was discovered under an angle considerable enough to lead the observer, Don Manual Baruti, to conclude that the volcano might have been visible at nine miles farther. It was in September, towards evening, and in very damp weather. Reckoning fifteen feet for the elevation of the eye, I find, that to render an account of this phenomenon, we must suppose a refraction equal to 0.158 of the arch, which is not very extraordinary for the temperate zone. According to the observations of General Roy, the refractions vary in England from one-twentieth to one-third; and if it be true that they reach these extreme limits on the coast of Africa, (which $I$ much doubt,) the peak, in certain circumstances, may be seen on the deck of a vessel as far off as 61 leagues.

Navigators who have much frequented these latitudes, and who can reflect on the physical causes of the phenomena, are surprised that the peaks of Teyde and of the Azores* are sometimes visible at a very great distance, though at other times they are not seen when the distance is much less, and the sky appears serene and the horizon free from fogs. These circumstances are the more worthy

[^5]of attention because vessels returning to Europe, sometimes wait impatiently for a sight of these mountains, to rectify their longitude; and think themselves much farther off than they really are, when in fine weather these peaks are not perceptible at distances where the angles subtended must be very considerable. The constitution of the atmosphere has a great influence on the visibility of distant objects. It may be admitted, that in general the peak of Teneriffe is seldom seen at a great distance, in the warm and dry months of July and August ; and that, on the contrary, it is seen at very extraordinary distances in the months of January and February, when the sky is slightly clouded, and immediately after a heavy rain, or a few hours before it falls. It appears that the transparency of the air is prodigiously increased, as we have already observed, when a certain quantity of water is uniformly diffused through the atmosphere. Independent of these observations, it is not astonishing, that the peak of Teyde should be seldomer visible at a very remote distance, than the summits of the Andes, to which, during so long a time, my observations were directed. This peak, inferior in height to those parts of the chain of Mount Atlas at the foot of which is the city of Morocco, is not, like those points, covered with perpetual snows. The Piton, or Sugar-loaf, which terminates the peak, no doubt reflects a great quantity of light, owing to the whitish colour of the pumice-stone thrqwn up by the crater; but the height of that little truncated cone does not form a twenty-second part of the total elevation. The flanks of the volcano are covered either with blocks of black and scorified lava, or with a luxuriant vegetation, the masses of which reflect the less light, as the leaves of the trees are separated from each other by shadows of more considerable extent than that of the part enlightened.

Hence it results that, setting aside the Piton, the peak of Teyde belongs to that class of mountains, which, according to the expression of Bouger, are seen at considerable distances only in a negative manner, because they intercept the light which is transmitted to us from the extreme limits of the atmosphere; and we perceive their existence only on account of the difference of intensity subsisting between the aerial light which surrounds them, and that which is reflected
by the particles of air placed between the mountains and the eye of the observer. As we withdraw from the isle of Teneriffe, the Piton or Sugar-loaf is seen for a considerable space of time in a positive manner, because it reflects a whitish light, and clearly detaches itself from the sky: But as this cone is only 80 toises high, by 40 in breadth at its summit, it has recently been a question whether, from the diminutiveness of its mass, it can be visible at distances which exceed 40 leagues; and whether it be not probable, that navigators distinguish the peaks as a small cloud above the horizon, only when the base of the Piton begins to be visible on it. If we admit, that the mean breadth of the Sugar-loaf is 100 toises, we find that the little cone, at 40 leagues distance, still subtends, in the horizontal direction, an angle of more than three minutes. This angle is considerable enough to render an object visible; and if the height of the Piton greatly exceeded its base, the angle in the horizontal direction might be still smaller, and the object still continue to make an impression on our visual organs; for micrometrical observations have proved that the limit of vision is but a minute only, when the dimensions of the objects are the same in every direction. We distinguish at a distance, by the eye only, trunks of trees insulated in a vast plain, though the subtended angle be under twenty-five seconds.

As the visibility of an object detaching itself in a brown colour, depends on the quantities of light which the eye meets on two lines, one of which ends at the mountain, and the other extends to the surface of the aerial ocean, it follows that the farther we remove from the object, the smaller the difference becomes between the light of the surrounding atmosphere, and that of the strata of air before the mountain. For this reason, when less elevated summits begin to appear above the horizon, they present themselves at first under a darker hue than those we discern at very great distances. In the same manner, the visibility of mountains seen only in a negative manner, does not depend solely on the state of the lower regions of the air, to which our meteorological observations are limited, but also on the transparency and physical constitution of the air in the most elevated parts; for the image detaches itself better in proportion as the aërial light, which comes from the limits of the atmosphere, has been
originally more intense, or has undergone less loss in its passage. This consideration explains to a certain point, why, under a perfectly serene sky, the state of the thermometer and the hygrometer being precisely the same in the air nearest the earth, the peak is sometimes visible, and at other times invisible, to navigators at equal distances. It is even probable, that the chance of perceiving this volcano would not be greater, if the ashy cone, at the summit of which is the month of the crater, were equal, as in Vesuvius, to a quarter of the total height. These ashes, being pumice-stone crumbled into dust, do not reflect as much light as the snow of the Andes; and they cause the mountain, seen from afar, to detach itself not in a bright, but in a dark hue. The ashes also contribute, if we may use the expression, to equalize the portions of aërial light, the variable difference of which renders the object more or less distinctly visible. Calcareous mountains, devoid of vegetable earth, summits covered with granitic sand, the high savannahs of the Cordilleras,* which are of a golden yellow, are undoubtedly distinguished at small distances better than objects which are seen in a negative manner; but the theory indicates a certain limit, beyond which these last detach themselves more distinctly from the azure vault of the sky.

The colossal summits of Quito and Peru, towering above the limit of the perpetual snows, concentre all the peculiarities which must render them visible at very small angles. The circular summit of the peak of Teneriffe is only a hundred toises in diameter. According to the measures I made at Riobamba, in 1803, the dome of the Chimborazo, 153 toises below its summit, consequently in a point which is 1300 toises ligher than the peak, is still 673 toises (1312 metres) in breadth. The zone of perpetual snows also forms a fourth of the height of the mountain; and the base of this zone, seen on the coast of the Pacific, fills an extent of 3437 toises ( 6700 metres). But though Chimborazo is two-thirds higher than the peak, we do not see it, on account of the curve of the globe, at more than 38 miles and a third farther distant. The radiant brilliancy of its snows, when, at the port of Guayaquil, at the close of the rainy season, Chimbo-

* Los Pajonales, from paja, straw. This is the name given to the region of the gramina, which encircles the zone of the perpetual snows.
razo is discerned on the horizon, may lead us to suppose, that it must be seen at a very great distance in the South Sea. Pilots highly worthy of credit have assured me, that they have seen it from the rock of Muerto, to the south west of the isle of Puna, at a distance of 47 leagues. Whenever it has been seen at a greater distance, the observers, uncertain of their longitude, have not been in a situation to furnish precise data.

Aërial light, projected on mountains, intreases the visibility of those which are seen positively ; its power diminishes, on the contrary, the visibility of objects which, like the peak of Teneriffe and that of the Azores, detach themselves in a brown tint. Bouguer, relying on theoretical considerations, was of opinion that, according to the constitution of our atmosphere, mountains seen negatively cannot be perceived at distances exceeding 35 leagues. It is important here to observe, that these calculations are contrary to experience. The peak of Teneriffe has been often seen at the distance of 36,38 , and even at 40 leagues. Moreover, in the vicinity of the Sandwich Islands, the summit of Mowna-Roa, at a season when it was without snows, has been seen on the skirt of the horizon, at the distance of 53 leagues. This is the most striking example we have hitherto known of the visibility of a mountain; and it is the more remarkable, that an object seen negatively furnishes this example.

The volcanoes of Teneriffe, and of the Azores, the Sierra Nevada of St. Martha, the peak of Orizaba, the Silla of Caracas, Mowna-Roa, and Mount St. Elias, insulated in the vast extent of the seas, or placed on the coasts of continents, serve as sea-marks to direct the pilot, when he has no means of determining the position of the vessel by the observation of the stars; everything which has a relation to the visibility of these natural seamarks, is interesting to the safety of navigation.

## Chapter II.

Stay at Teneriffe.-Journey from Santa Cruz to Orotava.-Excursion to the summit of the Peak of Teyde.
From the time of our departure from Graciosa, the horizon continued so hazy, that, notwithstanding the considerable height of the mountains of Canary,* we did not discover that island till the evening of the 18th of June. It is the granary of the archipelago of the Fortunate Islands; and, what is very remarkable in a region situated beyond the limits of the tropics, we were assured, that in some districts, there are two wheat harvests in the year; one in February, and the other in June. Canary has never been visited by a learned mineralogist; yet this island is so much the more worthy of observation, as the physiognomy of its mountains, disposed in parallel chains, appeared to me to differ entirely from that of the summits of Lancerota and Teneriffe. Nothing is more interesting to the geologist, than to observe the relations, on the same point of the globe, between volcanic countries, and those which are primitive or secondary. When the Canary Islands shall have been examined, in all the parts which compose the system of these mountains, we shall find that we have been too precipitate in considering the whole group as raised by the action of submarine fires.

On the morning of the 19th, we discovered the point of Naga, but the peak of Teneriffe was still invisible: the land, obscured by a thick mist, presented forms that were vague and confused. As we. approached the road of Santa Cruz, we observed that the mist, driven by the winds, drew nearer to us. The sea was strongly agitated, as it most commonly is in those latitudes. We anchored after several soundings, for the mist was so thick, that we could scarcely distinguish objects at a few cables' distance; but at the moment we began to salute the place, the fog was instantly dispelled. The peak of Teyde appeared in a break above the clouds, and the first rays of the sun, which had not yet risen on us, illumined the summit of the volcano.

We hastened to the prow of the vessel to behold the mag* Isla de la Gran Canaria.
nificent spectacle, and at the same instant we saw four English vessels lying to, and very near our stern. We had passed without being perceived, and the same mist which had concealed the peak from our view, had saved us from the risk of being carried back to Europe. The Pizarro stood in as close as possible to the fort, to be under its protection. It was on this shore, that, in the landing attempted by the English two years before our arrival, in July 1797, admiral Nelson had his arm carried off by a cannon-ball.

The situation of the town of Santa Cruz is very similar to that of La Guayra, the most frequented port of the province of Caraccas. The heat is excessive in both places, and from the same causes; but the aspect of Santa Cruz is more gloomy. On a narrow and sandy beach, houses of dazzling whiteness, with flat roofs, and windows without glass, are built close against a wall of black perpendicular rock, devoid of vegetation. A fine mole, built of freestone, and the public walk planted with poplars, are the only objects which break the sameness of the landscape. The view of the peak, as it presents itself above Santa Cruz, is much less picturesque than that we enjoy from the port of Orotava. There, a highly cultured and smiling plain presents a pleasing contrast to the wild aspect of the volcano. From the groups of palm trees and bananas which line the coast, to the region of the arbutus, the laurel, and the pine, the volcanic rock is crowned with luxuriant vegetation. We easily conceive how the inhabitants, even of the beautiful climates of Greece and Italy, might fancy they recognised one of the Fortunate Isles in the western part of Teneriffe. The eastern side, that of Santa Cruz, on the contrary, is every where stamped with sterility. The summit of the peak is not more arid than the promontory of basaltic lava, which stretches towards the point of Naga, and on which succulent plants, springing up. in the clefts of the rocks, scarcely indicate a preparation of soil. At the port of Orotava, the top of the Piton subtends an angle in height of more than eleven degrees and a half; while at the mole of Santa Cruz* the angle scarcely exceeds $4^{\circ} 36^{\circ}$.

Notwithstanding this difference, and though in the latter

[^6]place the volcano rises above the horizon scarcely as much as Vesuvius seen from the mole of Naples, the aspect of the peak is still very majestic, when those who anchor in the road discern it for the first time. The Piton alone was visible to us; its cone projected itself on a sky of the purest blue, whilst dark thick clouds enveloped the rest of the mountain to the height of 1800 toises. The pumice-stone, illumined by the first rays of the sun, reflected a reddish light, like that which tinges the summits of the higher Alps, This light by degrees becomes dazzlingly white ; and, deceived like most travellers, we thought that the peak was atill covered with snow, and that we should with difficulty reach the edge of the crater.

We have remarked, in the Cordillera of the Andes, that the conical mountains, such as Cotopaxi and Tungurahua, are oftener seen free from clouds, than those of which the tops are broken into bristly points, like Antisana and Pichincha; but the peak of Teneriffe, notwithstanding its pyramidical form, is a great part of the year enveloped in vapours, and is sometimes, during several weeks, invisible from the road of Santa Cruz. Its position to the west of an immense continent, and its insulated situation in the midst of the sea, are no doubt the causes of this phenomenon. Navigators are well aware that even the smallest islets, and those which are without mountains, collect and harbour the clouds. The decrement of heat is also different above the plains of Africa, and above the surface of the Atlantic; and the strata of air, brought by the trade winds, cool in proportion as they advance towards the west. If the air has been extremely dry above the burning sands of the desert, it is very quickly saturated when it enters into contact with the surface of the sea, or with the air that lies on that surface. It is easy to conceive, therefore, why vapours become visible in the atmospherical strata, which, at a distance from the continent, have no longer the same temperature as when they began to be saturated with water. The considerable mass of a mountain, rising in the midst of the Atlantic, is also an obstacle to the clouds, which are driven out to see by the winds.

On entering the streets of Santa Cruz, we felt a suffocating heat, though the thermometer was not above twenty-
five degrees. Those who have for a long time inhaled the air of the sea suffer every time they land; not because this air contains more oxygen than the air on shore, as has been erroneously supposed, but because it is less charged with those gaseous combinations, which the animal and vegetable substances, and the mud resulting from their decomposition, pour into the atmosphere. Miasms that escape chemical analysis have a powerful effect on our organs, especially when they have not for a long while been exposed to the same kind of irritation.

Santa Cruz, the Añaza of the Guanches, is a neat town, with a population of 8000 souls. I was not struck with the vast number of monks and secular ecclesiastics, which travellers have thought themselves bound to find in every country under the Spanish government; nor shall I stop to enter into the description of the churches; the library of the Dominicans, which contains scarcely a few hundred volumes; the mole, where the inhabitants assemble to inhale the freshness of the evening breeze; or the famed monument of Carrara marble, thirty feet high, dedicated to Our Lady of Candelaria, in memory of the miraculous appearance of the Virgin, in 1392, at Chimisay, near Guimar. The port of Santa Cruz may be considered as a great caravanserai, on the road to America and the Indies. Every traveller who writes the narrative of his adventures, begins by a description of Madeira and Teneriffe; and if in the natural history of these islands there yet remains an immense field untrodden, we must admit that the topography of the little towns of Funchal, Santa Cruz, Laguna, and Orotava, leaves scarcely anything untold.

The recommendation of the court of Madrid procured for us, in the Canaries, as in all the other Spanish possessions, the most satisfactory reception. The captain-general gave us immediate permission to examine the island. Col. Armiaga, who commanded a regiment of infantry, received us into his house with kind hospitality. We could not cease admiring the banana, the papaw tree, the Poinciana pulcherrima, and other plants, which we had hitherto seen only in hot-houses, cultivated in his garden in the open air. The climate of the Canaries however is not warm enough to ripen the real Platano Arton, with triangular fruit from seven to eight
inches long, and which, requiring a temperature of 24 centesimal degrees, does not flourish even in the valley of Caracas. The bananas of Teneriffe are those named by the Spanish planters Camburis or Guineos, and Dominicos. The Camburi, which suffers least from cold, is cultivated with success even at Malaga, where the temperature is only 18 degrees; but the fruit we see occasionally at Cadiz comes from the Canary Islands by vessels which make the passage in three or four days. In general, the musa, known by every people under the torrid zone, though hitherto never found in a wild state, has as great a variety of fruit as our apple and pear trees. These varieties, which are confounded by the greater part of botanists, though they require very different climates, have become permanent by long cultivation.

We went to herborize in the evening in the direction of the fort of Passo Alto, along the basaltic rocks that close the promontory of Naga. We were very little satisfied with our harvest, for the drought and dust had almost destroyed vegetation. The Cacalia Kleinia, the Euphorbia canariensis, and several other succulent plants, which draw their nourishment from the air rather than the soil on which they grow, reminded us by their appearance, that this group of islands belongs to Africa, and even to the most arid part of that continent.

Though the captain of the Pizarro had orders to stop long enough at Teneriffe to give us time to scale the summit of the peak, if the snows did not prevent our ascent, we received notice, on account of the blockade of the English ships, not to expect a longer delay than four or five days. We consequently hastened our departure for the port of Orotava, which is situated on the western declivity of the volcano, where we were sure of finding gudes. I could find no one at Santa Cruz who had mounted the peak, and I was not surprised at this. The most curious objects become less interesting, in proportion as they are near to us; and I have known inhabitants of Schaffhausen, in Switzerland, who had never seen the fall of the Rhine but at a distance.

On the 20th of June, before sunrise, we began our excursion by ascending to the Villa de Laguna, estimated to bo at the elevation of 350 toises above the port of Santa Cruz. vol. I.

We could not verify this estimate of the height, the surf not haring permitted us to return on board during the night, to take our barometers and dipping-needle. As we foresaw that our expedition to the peak would be very precipitate, we consoled ourselves with the reflection that it was well not to expose instruments which were to serve us in countries less known by Europeans. The road by which we ascended to Laguna is on the right of a torrent, or baranco, which in the rainy season forms fine cascades; it is narrow and tortuous. Near the town we met some white camels, which seemed to be very slightly laden. The chief employment of these animals is to transport merchandise from the custom-house to the warehouses of the merchants. They are generally laden with two chests of Havannah sugar, which together weigh 900 pounds; but this load may be augmented to thirteen hundred-weight, or 52 arrobas of Castile. Camels are not numerous at Teneriffe, whilst they exist by thousands in the two islands of Lancerota and Forteventura; the climate and vegetation of these islands, which are situated nearer Africa, are more analogous to those of that continent. It is very extraordinary, that this useful animal, which breeds in South America, should be seldom propagated at Teneriffe. In the fertile district of Adexe only, where the plantations of the sugar-cane are most considerable, camels have sometimes been known to breed. These beasts of burden, as well as horses, were brought into. the Canary Islands in the fifteenth century by the Norman conquerors. The Guanches were previously unacquainted with them; and this fact seems to be very well accounted for by the difficulty of transporting an animal of such bulk in frail canoes, without the necessity of considering the Guanches as a remnant of the people of Atlantis, or a different race from that of the western Africans.

The hill, on which the town of San Christobal de la Laguna is built, belongs to the system of basaltic mountains, which, independent of the system of less ancient volcanic rocks, form a broad girdle around the peak of Teneriffe. The basalt on which we walked was darkish brown, compact, half-decomposed, and when breathed on, emitted a clayey smell. We discovered amphibole, olivine,* and translucid pyrox* Peridot granuliforme. Hauy.
enes,* with a perfectly lamellar fracture, of a pale olive green, and often crystallized in prisms of six planes. The first of these substances is extremely rare at Teneriffe ; and I never found it in the lavas of Vesuvius; but those of Etna contain it in abundance. Notwithstanding the great number of blocks, which we stopped to break, to the great regret of our guides, we could discover neither nepheline, lencite, $\dagger$ nor feldspar. This last, which is so common in the bassaltic lavas of the island of Ischia, does not begin to appear at Teneriffe, till we approach the volcano. The rock of Laguna is not columnar, but is divided into ledges, of small thickness, and inclined to the east at an angle of 30 or 40 degrees. It has nowhere the appearance of a current of lava flowing from the sides of the peak. If the present volcano has given birth to these basalts, we must suppose, that, like the substances which compose the Somma, at the back of Vesuvius, they are the effect of a submarine effusion, in which the liquid mass has formed strata. A few arborescent Euphorbias, the Cacalia Kleinia, and Indian figs (Cactus), which have become wild in the Canary Islands, as well as in the south of Europe and the whole continent of Africa, are the only plants we see on these arid roeks. The feet of our mules were slipping every moment on beds of stone, which were very steep. We nevertheless recognized the remains of an ancient pavement. In these colonies we discover at every step some traces of that activity which characterized the Spanish nation in the 16th century.

As we approached Laguna, we felt the temperature of the atmosphere gradually become lower. This sensation was so much the more agreeable, as we found the air of Santa Cruz very oppressive. As our organs are more affected by disagreeable impressions, the change of temperature becomes still more sensible when we return from Laguna to the port: we seem then to be drawing near the mouth of a furnace. The same impression is felt, when, on the coast of Caracas, we descend from the mountain of Avila to the port of La Guayra. According to the law of the decrement of heat, three hundred and fifty toises in height produce in this latitude only three or four degrees difference in temperature.

The heat which overpowers the traveller on his entrance into Santa Cruz, or La Guayra, must consequently be attributed to the reverberation from the rocks, against which these towns are built.

The perpetual coolness which prevails at Laguna causes it to be considered in the Canaries a delightful abode. Situated in a small plain, surrounded by gardens, protected by a hill which is crowned by a wood of laurels, myrtle, and arbutus, the capital of Teneriffe is very beautifully placed. We should be mistaken if, relying on the account of some travellers, we believed it seated on the border of a lake. The rain sometimes forms a sheet of water of considerable extent; and the geologist, who beholds in everything the past rather than the present state of nature, can have no doubt but that the whole plain is a great basin dried up. Laguna has fallen from its opulence, since the lateral eruptions of the volcano have destroyed the port of Garachico, and since Santa Cruz has become the central point of the commerce of the island. It contains only 9000 inhabitants, of whom nearly 400 are monks, distributed in six convents. The town is surrounded with a great number of windmills, which indicate the cultivation of wheat in these high countries. I shall observe on this occasion, that different kinds of grain were known to the Guanches. They called wheat at Teneriffe tano, at Lancerota triffa; barley, in the grand Canary, bore the name of aramotanoque, and at Lancerota it was called tamosen. The flour of roasted barley (gofio) and goat's-milk constituted the principal food of the people, on the origin of which so many systematic fables have been current. These aliments sufficiently.prove that the race of the Guanches belonged to the nations of the old continent, perhaps to those of Caucasus, and not like the rest of the Atlantides,* to the inhabitants of the New World ; these, before the arrival of the Europeans, were unacquainted with corn, milk, and cheese.

A great number of chapels, which the Spaniards call ermi-

[^7]tas, encircle the town of Laguna. Shaded by trees of perpetual verdure, and erected on small eminences, these chapels add to the picturesque effect of the landscape. The interior of the town is not equal to its external appearance. The houses are solidly built, but very antique, and the streets seem deserted. A botanist ought not to complain of the antiquity of the edifices. The roofs and walls are covered with Canary house-leek and those elegant trichomanes, mentioned by every traveller. These plants are nourished by the abundant mists.
Mr. Anderson, the naturalist in the third voyage of captain Cook, advises physicians to send their patients to Teneriffe, on account of the mildness of the temperature and the equal climate of the Canaries. The ground on these islands rises in an amphitheatre, and presents simultaneously, as in Peru and Mexico, the temperature of every climate, from the heat of Africa to the cold of the higher Alps. Santa Cruz, the port of Orotava, the town of the same name, and that of Laguna, are four places, the mean temperatures of which form a descending series. In the south of Europe the change of the seasons is too sensibly felt to present the same advantages. Teneriffe, on the contrary, situated as it were on the threshold of the tropics, though but a few days' sail from Spain, shares in the charms which nature has lavished on the equinoctial regions. Vegetation here displays some of her fairest and most majestic forms in the banana and the palm-tree. He who is alive to the charms of nature finds in this delicious island remedies still more potent than the climate. No abode appeared to me more fitted to dissipate melancholy, and restore peace to the perturbed mind, than that of Teneriffe or Madeira. These advantages are the effect not of the beauty of the site and the purity of the air alone: the moral feeling is no longer harrowed up by the sight of slavery, the presence of which is so revolting in the West Indies, and in every other place to which European colonists have conveyed what they call their civilization and their industry.
In winter the climate of Laguna is extremely foggy, and the inhabitants often complain of the cold. A fall of snow, however, has never been seen; a fact which may seem to indicate
that the mean temperature of this town must be above $18.7^{\circ}$ ( $15^{\circ} \mathrm{R}$.), that is to say, higher than that of Naples. I do not lay this down as an unexceptional conclusion, for in winter the refrigeration of the clouds does not depend so much on the mean temperature of the whole year, as on the instantaneous diminution of heat to which a district is exposed by its local situation. The mean temperature of the capital of Mexico, for instance, is only $16.8^{\circ}\left(13^{\circ} 5^{\circ}\right.$ R.), nevertheless, in the space of a hundred years snow has fallen only once, while in the south of Europe and in Africa it snows in places where the mean temperature is above 19 degrees.

The vicinity of the sea renders the climate of Laguna more mild in winter than might be expected, arising from its elevation above the level of the ocean. I was astonished to learn that M. Broussonnet had planted in the midst of this town, in the garden of the Marquis de Nava, the bread-fruit tree (Artocarpus incisa), and cinna-mon-tree (Laurus Cinnamomum). These valuable productions of the South Sea and the East Indies are naturalized there as well as at Orotava. Does not this fact prove that the bread-fruit might flourish in Calabria, Sicily, and Granada? The culture of the coffee-tree has not equally succeeded at Laguna, though its fruit ripens at Teguesta, as well as between the port of Orotava and the village of St. Juan de la Rambla. It is probable that some local circumstances, perhaps the nature of the soil and the winds that prevail in the flowering season, are the cause of this phenomenon. In other regions, in the neighbourhood of Naples, for instance, the coffee-tree thrives abundantly, though the mean temperature scarcely rises above 18 centigrade degrees.

No person has ascertained in the island of Teneriffe, the lowest height at which snow falls every year. This fact, though easy of verification by barometrical measurements, has hitherto been generally neglected under every zone. It is nevertheless highly interesting both to agriculture in the colonies and meteorology, and fully as important as the measure of the limit of the perpetual snows. My observations furmshed me with the data, set down in the following table:-

| North letitudo. | Lowest height at which snow falls. |  | Inferior limit of the perpetual anows. |  | Difference of the two preceding columns. |  | $\underset{\text { temperature. }}{\text { Moen }}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Toises. | Metres. | Toises. | Metres. | Toises. | Metres. | Cent. | Rexam. |
| $0{ }^{\circ}$ | 2040 | 3976 | 2460 | 4794 | 420 | 818 | $27^{\circ}$ | 21.60 |
| $20^{\circ}$ | 1550 | 3020 | 2360 | 4598 | 810 | 1578 | $24.5{ }^{\circ}$ | $19.6{ }^{\circ}$ |
| $40^{\circ}$ | 0 | 0 | 1540 | 3001 | 1540 | 3001 | $17^{\circ}$ | $13.6{ }^{\circ}$ |

This table presents only the ordinary state of nature, that is to say, the phenomena as they are annually observed. Exceptions founded on particular local circumstances, exist. Thus it sometimes snows, though seldom, at Naples, at Lisbon, and even at Malaga, consequently as low as the 37th degree of latitude : and, as we have just observed, snow has been seen to fall at Mexico, the elevation of which is 1173 toises above the level of the ocean. This phenomenon, which had not been seen for several centuries, took place on the day that the Jesuits were expelled, and was attributed by the people to that act of severity. A more striking exception was found in the climate of Valladolid, the capital of the province of Mechoacan. According to my measures, the height of this town, situate in latitude $19^{\circ} 42^{\prime}$, is only a thousand toises: and yet, a few years before our arrival in New Spain, the streets were covered with snow for some hours.

Snow had been seen to fall also at Teneriffe, in a place lying above Esperanza de la Laguna, very near the town of that name, in the gardens of which the artocarpus flourishes. This extraordinary fact was confirmed to M. Broussonnet by very aged persons. The Erica arborea, the Myrica Faya, and the Arbutus callicarpa,* did not suffer from the snow; but it destroyed all the vines in the open air. This observation is interesting to vegetable physiology a In hot countries, the plants are so vigorous, that cold is less injurious to them,
*This fine arbutus, imported by M. Broussonnet, is very different from the Arbutus laurifolia, with which it has been confounded, but which belongs to North America.
provided it be of short duration. I have seen the banana cultivated in the island of Cuba, in places where the thermometer descends to seven centesimal degrees, and sometimes very near freezing point. In Italy and Spain the orange and date-trees do not perish, though the cold during the night may be two degrees below freezing point. In general it is remarked by cultivators, that the trees which grow in a fertile soil are less delicate, and consequently less affected by great changes in the temperature, than those which grow in land that affords but little nutriment.*

In order to pass from the town of Laguna to the port of Orotava and the western coast of Teneriffe, we cross at first a hilly region covered with black and argillaceous earth, in which are found some small crystals of pyroxene. The waters most probably detach these crystals from the neighbouring rocks, as at Frascati, near Rome. Unfortunately, strata of ferruginous earth conceal the soil from the researches of the geologist. It is only in some ravines, that we find columnar basalts, somewhat curved, and above them very recent breccia, resembling volcanic tufa. The breccia contain fragments of the same basalts which they cover; and it is asserted that marine petrifactions are observed in them. The same phenomenon occurs in the Vicentin, near Montechio Maggiore.

The valley of Tacoronte is the entrance into that charming country, of which travellers of every nation have spoken with rapturous enthusiasm. Under the torrid zone I found sites where nature is more majestic, and richer in the display of organic forms; but after having traversed the banks of the Orinoco, the Cordilleras of Peru, and the most beautiful valleys of Mexico, I own that I have never beheld a prospect more varied, more attractive, more harmonious in the distribution of the masses of verdure and of rocks, than the western coast of Teneriffe.

[^8]The sea-coast is lined with date and cocoa trees. Groups of the musa, as the country rises, form a pleasing contrast with the dragon-tree, the trunks of which have been justly compared to the tortuous form of the serpent. The declivities are covered with vines, which throw their branches over towering poles. Orange trees loaded with flowers, myrtles, and cypress trees encircle the chapels reared to devotion on the isolated hills. The divisions of landed property are marked by hedges formed of the agave and the cactus. An innumerable quantity of cryptogamous plants, among which ferns are the most predominant, cover the walls, and are moistened by small springs of limpid water. In winter, when the volcano is buried under ice and snow, this district enjoys perpetual spring. In summer, as the day declines, the breezes from the sea diffuse a delicious freshness. The population of this coast is very considerable; and it appears to be still greater than it is, because the houses and gardens are distant from each other, which adds to the picturesque beauty of the scene. Unhappily the real welfare of the inhabitants does not correspond with the exertions of their industry, or with the advantages which nature has lavished on this spot. The farmers are not land-owners; the fruits of their labour belong to the nobles; and those feudal institutions, which, for so long a time, spread misery throughout Europe, still press heavily on the people of the Canary Islands.

From Tegueste and Tacoronte to the village of St. Juan de la Rambla (which is celebrated for its excellent malmsey wine), the rising hills are cultivated like a garden. I might compare them to the environs of Capua and Valentia, if the western part of Teneriffe was not infinitely more beautiful on account of the proximity of the peak, which presents on every side a new point of view. The aspect of this mountain is interesting not merely from its gigantic mass; it excites the mind, by carrying it back to the mysterious source of its volcanic agency. For thousands of years, no flames or light have been perceived on the summit of the Piton, nevertheless enormous lateral eruptions, the last of which took place in 1798, are proofs of the activity of a fire still far from being extinguished. There is also something that leaves a melancholy impression on beholding a crater in the centre
of a fertile and well cultivated country. The history of the globe informs us, that volcanoes destroy what they have been a long series of ages in creating. Islands, which the action of submarine fires has raised above the waters, are by degrees clothed in rich and smiling verdure; but these now lands are often laid waste by the renewed action of the same power which caused them to emerge from the battom of the ocean. Islets, which are now but heaps of scoriss and volcanic ashes, were once perhaps as fertile as the hills of Tacoronte and Sauzal. Happy the country, where man has no distrust of the soil on which he lives!

Pursuing our course to the port of Orotava, we passed the smiling hamlets of Matanza and Victoria. These names are mingled together in all the Spanish colonies, and they form an unpleasing contrast with the peaceful and tranquil feelings which those countries inspire. Matanza signifies slaughter, or carnage; and the word alone recalls the price at which victory has been purchased. In the New World it generally indicates the defeat of the natives: at Teneriffe, the village of Matanza was built in a place* where the Spaniards were conquered by those same Guanches who soon after were sold as slaves in the markets of Europe.

Before we reached Orotava, we visited a botanic garden at a little distance from the port. We there found M. Le Gros, the French vice-consul, who had often scaled the summit of the Peak, and who served us as an excellent guide. He was accompanying captain Baudin in a voyage to the WestIndies, when a dreadful tempest, of which M. Le Dru has given an account in the narrative of his voyage to Porto Rico, forced the vessel to put into Teneriffe. There M. Le Gros was led by the beauty of the spot to settle. It was he who augmented scientific knowledge by the first accurate ideas of the great lateral eruption of the Peak, which has been very improperly called the explosion of the volcano of Chahorra. This eruption took place on the 8th of June, 1798.

The establishment of a botanical garden at Teneriffe is a very happy idea, on account of the influence it is likely to have on the progress of botany, and on the introduction of useful plants into Europe. For the first conception of

[^9]it we are indebted to the Marquis de Nava. He undertook, at an enormous expense, to level the hill of Durasno, which rises as an amphitheatre, and which was begun to be planted in 1795. The marquis thought that the Canary Lslands, from the mildness of their climate and geographicai position, were the most suitable place for naturalising the productions of the East and West Indies, and for inuring the plants gradually to the colder temperature of the south of Europe. The plants of Asia, Africa, and South America, may easily be brought to Orotava; and in order to introduce the bark-tree* into Sicily, Portugal, or Grenada, it should be first planted at Durasno, or at Laguna, and the shoots of this tree may afterwards be transported into Europe from the Canaries. In happier times, when maritime wars shall no longer interrupt communication, the garden of Teneriffe may become extremely useful with respect to the great number of plants which are sent from the Indies to Europe; for ere they reach our coasts, they often perish, owing to the length of the passage, during which they inhale an air impregnated with salt water. These plants would meet at Orotava with the care and climate necessary for their preservation. At Durasno, the protea, the psidium, the jambos, the chirimoya of Peru, $\dagger$ the sensitive plant, and the heliconia, grow in the open air. We gathered the ripened seeds of several beautiful species of glycine from New Holland, which the governor of Cumana, Mr. Emparan, had successfully cultivated, and which grow wild on the coasts of South America.

We arrived very late at the port of Orotava, $\ddagger$ if we may give the name of port to a road in which vessels are obliged to put to sea whenever the winds blow violently from the north-west. It is impossible to speak of Orotava

[^10]without recalling to the remembrance of the friends of science the name of Don Bernardo Cologan, whose house at all times was open to travellers of every nation.

We could have wished to have sojourned for some time in Don Bernardo's house, and to have visited with him the charming scenery of St. Juan de la Rambla and of Rialexo de Abaxo.*. But on a voyage such as we had undertaken, the present is but little enjoyed. Continually haunted by the fear of not executing the designs of the morrow, we live in perpetual uneasiness. Persons who are passionately fond of nature and the arts feel the same sensations, when they travel through Switzerland and Italy. Enabled to see but a small portion of the objects which allure them, they are disturbed in their enjoyments by the restraints they impose on themselves at every step.

On the morning of the 21st of June, we were on our way to the summit of the volcano. M. le Gros, whose attentions were unwearied, M. Lalande, secretary to the French Consulate at Santa Cruz, and the English gardener at Durasno, joined us on this excursion. The day was not very fine, and the summit of the peak, which is generally visible at Orotava from sunrise till ten o'clock, was covered with thick clouds.

We were agreeably surprised by the contrast between the vegetation of this part of Teneriffe, and that of the environs of Santa Cruz. Under the influence of a cool and humid climate, the ground was covered with beautiful verdure; while on the road from Santa Cruz to Laguna the plants exhibited nothing but capsules emptied of their seeds. Near the port of Santa Cruz, the strength of the vegetation is an obstacle to geological research. We passed along the base of two small hills, which rise in the form of bells. Observations made at Vesuvius and in Auvergne lead us to think that these hills owe their origin to lateral eruptions of the great volcano. The hill called Montañita de la Villa seems indeed to have emitted lavas; and according to the tradition of the Guanches, an eruption took place in 1430. Colonel Franqui assured Borda, that the place is still to be seen whence the melted matter

[^11]issued; and that the ashes which covered the ground adjacent, were not yet fertilized. Whenever the rock appeared, we discovered basaltic amygdaloid* covered with hardened clay, $\dagger$ which contains rapilli, or fragments of pumice-stone. This last formation resembles the tufas of Pausilippo, and the strata of puzzolana, which I found in the valley of Quito, at the foot of the volcano of Pichincha. The amygdaloid has very long pores, like the superior strata of the lavas of Vesuvius, arising probably from the action of an elastic fluid forcing its way through the matter in fusion. Notwithstanding these analogies, I must here repeat, that in all the low region of the peak of Teneriffe, on the side of Orotava, I have met with no flow of lava, nor any current, the limits of which are strongly marked. Torrents and inundations change the surface of the globe, and when a great number of currents of lava meet and spread over a plain, as I have seen at Vesuvius, in the Atrio dei Cavalli, they seem to be confounded together, and wear the appearance of real strata.

The villa de Orotava has a pleasant aspect at a distance, from the great abundance of water which runs through the principal streets. The spring of Agua Mansa, collected in two large reservoirs, turns several mills, and is afterward discharged among the vineyards of the adjacent hills. The climate is still more refreshing at the villa than at the port of La Cruz, from the influence of the breeze, which blows strong after ten in the morning. The water, which has been dissolved in the air at a higher temperature, frequently precipitates itself, and renders the climate very foggy. The villa is nearly 160 toises ( 312 metres) above the level of the sea, consequently 200 toises lower than the site on which Laguna is built: it is observed also, that the same kind of plants flower a month later in this latter place.

Orotava, the ancient Taoro of the Guanches, is situated on a very steep declivity. The streets seem deserted; the houses are solidly built, and of a gloomy appearance. We passed along a lofty aqueduct, lined with a great number of fine ferns; and visited several gardens, in which the fruit trees of the north of Europe are mingled with orange trees,

[^12]pomegranate, and date trees. We were assured, that theselast were as little productive here as on the coast of Cumana. Although we had been made acquainted, from the narratives of many travellers, with the dragon-tree of the garden of M. Franqui, we were not the less struck with its enormous magnitude. We were told, that the trunk of this tree, which is mentioned in several very ancient documents as marking the boundaries of a field, was as gigantic in the fifteenth century as it is at the present time. Its height appeared to us to be about 50 or 60 feet ; its circumference near the roots is 45 feet. We could not measure higher, but Sir George Staunton found that, 10 feet from the ground, the diameter of the trunk is still 12 English feet; which corresponds perfectly with the statement of Borda, who found its mean circumference 33 feet 8 inches, French measure. The trunk is divided into a great number of branches, which rise in the form of a candelabrum, and are terminated by tufts of leaves, like the yucca which adorns the valley of Mexico. This division gives it a very different appearance from that of the palm-tree.

Among organic creations, this tree is undoubtedly, together with the Adansonia or baobab of Senegal, one of the oldest inhabitants of our globe. The baobabs are of still greater dimensions than the dragon-tree of Orotava. There are some which near the root measure 34 feet in diameter, though their total height is only from 50 to 60 feet. But we should observe, that the Adamsonia, like the ochroma, and all the plants of the family of bombax, grow much more rapidly" than the dracœena, the vegetation of which is very slow. That in M. Franqui's garden still bears every year

[^13]both flowers and fruit. Its aspect forcibly exemplifies "that eternal youth of nature," which is an inexhaustible source of motion and of life.

The dracæna, which is seen only in cultivated spots in the Canary Islands, at Madeira, and Porto Santo, presents a curious phenomenon with respect to the migration of plants. It has never been found in a wild state on the continent of Africa. The East Indies is its real country. How has this tree been transplanted to Teneriffe, where it is by no means common? Does its existence prove, that, at some very distant period, the Guanches had connexions with other nations originally from Asia ?*

On leaving Orotava, a narrow and stony pathway led us through a beautiful forest of chesnut trees (el monte de Castaños), to a site covered with brambles, some species of laurels, and arborescent heaths. The trunks of the latter grow to an extraordinary size; and the flowers with which they are loaded form an agreeable contrast, during a great part of the year, to the Hypericum canariense, which is very abundant at this height. We stopped to take in our provision of water under a solitary fir-tree. This station is known in the country by the name of Pino del Dornajito. Its height, according to the barometrical measurement of $M$. de Borda, is 522 toises; and it commands a magnificent prospect of the sea, and the whole of the northern part of the island. Near Pino del Dornajito, a little on the right of the pathway, is a copious spring of water, into which we plunged the thermometer, which fell to $15.4^{\circ}$. At a hundred toises distance from this spring is another equally limpid. If we admit that these waters indicate nearly the mean heat of the place whence they issue, we may fix the absolute elevation of the station at 520 toises, supposing the mean tempera-

[^14]ture of the coast to be 21 degrees, and allowing one degree for the decrement of caloric corresponding under this zone to 93 toises. We should not be surprised if this spring remained a little below the heat of the air, since it probably takes its source in some more elevated part of the peak, and possibly communicates with the small subterranean glaciers of which we shall speak hereafter. The accordance just observed between the barometrical and thermometrical measures is so much more striking, because in mountainous countries, with stcep declivities, the springs generally indicate too great a decrement of caloric, for they unite small currents of water, which filtrate at different heights, and their temperature is consequently the mean between the temperature of these currents. The spring of Dornajito has considerable reputation in the country; and at the time I was there, it was the only one known on the road which leads to the summit of the volcano. The formation of springs demands a certain regularity in the direction and inclination of the strata. On a volcanic soil, porous and splintered rocks absorb the rain waters, and convey them to considerable depths. Hence arises that aridity observed in the greater part of the Canary Islands, notwithstanding the considerable height of their mountains, and the mass of clouds which navigators behold incessantly overhanging this archipelago.

From Pino del Dornajito to the crater of the volcano we continued to ascend without crossing a single valley; for the small ravines (barancos) do not merit this name. To the eye of the geologist the whole island of Teneriffe is but one mountain, the almost elliptical base of which is prolonged to the north-east, and in which may be distinguished several systems of volcanic rocks formed at different epochs. The Chahorra, or Montaña Colorada, and the Urca, considered in the country as insulated volcanoes, are only little hills abutting on the peak, and masking its pyramidal form. The great volcano, the lateral eruptions of which have given birth to vast promontories, is not however precisely in the centre of the island, and this peculiarity of structure appears the less surprising, if we recollect that, as the learned mineralogist M. Cordier has observed, it is not perhaps the small crater of the Piton which has been the principal agent in the changes undergone by the island of Teneriffe.

Above the region of arborescent heaths, called Monte Verde, is the region of ferns. Nowhere, in the temperate zone, have I seen such an abundance of the pteris, blechnum, and asplenium ; yet none of these plants have the stateliness of the arborescent ferns which, at the height of five or six hundred toises, form the principal ornament of equinoctial America. The root of the Pteris aquilina serves the inhabitants of Palma and Gomera for food; they grind it to powder, and mix with it a quantity of barley-meal. This composition, when boiled, is called gofio; the use of so homely an aliment is a proof of the extreme poverty of the lower order of people in the Canary Islands.

Monte Verde is intersected by several small and very arid ravines (cañadas), and the region of ferns is succeded by a wood of juniper trees and firs, which has suffered greatly from the violence of hurricanes. In this place, mentioned by some travellers under the name of Caravela," Mr. Eden states that in the year 1705 he saw little flames, which, according to the doctrine of the naturalists of his time, he attributes to sulphurous exhalations igniting spontaneously. We continued to ascend, till we came to the rock of La Gayta and to Portillo: traversing this narrow pass between two basaltic hills, we entered the great plain of Spartium. At the time of the voyage of Lapérouse, M. Manneron had taken the levels of the peak, from the port of Orotava to this elevated plain, near 1400 toises above the level of the sea; but the want of water, and the misconduct of the guides, prevented him from taking the levels to the top of the volcano. The results of the operation, (which was two-thirds completed,) unfortunately were not sent to Europe, and the work is still to be recommenced from the sea-coast.

We spent two hours and a half in crossing the Llano del Retama, which appears like an immense sea of sand. Notwithstanding the elevation of this site, the centigrade thermometer rose in the shade toward sunset, to $13.8^{\circ}$, or $3.7^{\circ}$ higher than toward noon at Monte Verde. This augmentation of heat could be attributed only to the reverberation

[^15]from the ground, and the extent of the plain. We suffered much from the suffocating dust of the pumice-stone, in which we were continually enveloped. In the midst of this plain are tufts of the retama, which is the Spartium nubige num of Aiton. M. de Martinière, one of the botanists who perished in the expedition of Lapérouse, wished to introduce this beautiful shrub into Languedoc, where firewood is very scarce. It grows to the height of nine feet, and is loaded with odoriferous flowers, with which the goat hunters, that we met in our road, had decorated their hats. The goats of the peak, which are of a deep brown colour, are reckoned delicious food; they browse on the spartium, and have run wild in the deserts from time immemorial. They have been transported to Madeira, where they are preferred to the goats of Europe.

As far as the rock of Gayta, or the entrance of the extensive Llano del Retama, the peak of Teneriffe is covered with beautiful vegetation. There are no traces of recent devastation. We might have imagined ourselves scaling the side of some volcano, the fire of which had been extinguished as remotely as that of Monte Cavo, near Rome; but scarcely had we reached the plain covered with pumicestone, when the landscape changed its aspect, and at every step we met with large blocks of obsidian thrown out by the volcano. Everything here speaks perfect solitude. A few goats and rabbits only bound across the plain. The barren region of the peak is nine square leagues; and as the lower regions viewed from this point retrograde in the distance, the island appears an immense heap of torrefied matter, hemmed round by a scanty border of vegetation.

From the region of the Spartium nubigenum we passed through narrow defiles, and small ravines hollowed at a very remote time by the torrents, first arriving at a more elevated plain (el Monton de Trigo), then at the place where we intended to pass the night. This station, which is more than 1530 toises above the coast, bears the name of the English Halt (Estancia de los Ingleses*), no doubt because most of

[^16]the travellers, who formerly visited the peak, were Englishmen. Two inclined rocks form a kind of cavern, which affords a shelter from the winds. This point, which is higher than the summit of the Canigou, can be reached on the backs of mules; and here has ended the expedition of numbers of travellers, who on leaving Orotava hoped to have ascended to the brink of the crater. Though in the midst of summer, and under an African sky, we suffered from cold during the night. The thermometer descended as low as to five degrees. Our guides made a large fire with the dry branches of retama. Having neither tents nor cloaks, we lay down on some masses of rock, and were singularly incommoded by the flame and smoke, which the wind drove towards us. We had attempted to form a kind of screen with cloths tied together, but our enclosure took fire, which we did not perceive till the greater part had been consumed by the flames. We had never passed a night on a point so elevated, and we then little imagined that we should, one day, on the ridge of the Cordilleras, inhabit towns higher than the summit of the volcano we were to scale on the morrow. As the temperature diminished, the peak became covered with thick clouds. The appproach of night interrupts the play of the ascending current, which, during the day, rises from the plains towards the high regions of the atmosphere; and the air, in cooling, loses its capacity of suspending water. A strong northerly wind chased the clouds; the moon at intervals, shooting through the vapours, exposed its disk on a firmament of the darkest blue; and the view of the volcano threw a majestic character over the nocturnal scenery. Sometimes the peak was entirely hidden from our eyes by the fog, at other times it broke upon us in terrific proximity; and, like an enormous pyramid, threw its shadow over the clouds rolling beneath our feet.

About three in the morning, by the sombrous light of a few fir torches, we started on our journey to the summit of the Piton. We scaled the volcano on the north-east side, where the declivities are extremely steep; and after two

[^17]hours' toil, we reached a small plain, which, on account of its elevated position, bears the name of Alta Vista. This is the station of the neveros, those natives, whose occupation it is to collect ice and snow, which they sell in the neighbouring towns. Their mules, better practised in climbing mountains than those hired by travellers, reach Alta Vista, and the neveros are obliged to transport the snow to that place on their backs. Above this point commences the Malpays, a term by which is designated here, as well as in Mexico, Peru, and every other country subject to volcanoes, a ground destitute of vegetable mould, and covered with fragments of lava.

We turned to the right to examine the cavern of ice, which is at the elevation of 1728 toises, consequently below the limit of the perpetual snows in this zone. Probably the cold which prevails in this cavern, is owing to the same causes which perpetuate the ice in the crevices of Mount Jura and the Apennines, and on which the opinions of naturalists are still much divided. This natural ice-house of the peak has, nevertheless, none of those perpendicular openings, which give emission to the warm air, while the cold air remains undisturbed at the bottom. It would seem that the ice is preserved in it on account of its mass, and because its melting is retarded by the cold, which is the consequence of quick evaporation. This small subterraneous glacier is situated in a region, the mean temperature of which is probably not under three degrees; and it is not, like the true glaciers of the Alps, fed by the snow waters that flow from the summits of the mountains. During winter the cavern is filled with ice and snow; and as the rays of the sun do not penetrate beyond the mouth, the heats of summer are not sufficient to empty the reservoir. The existence of a natural ice-house depends, consequently, rather on the quantity of snow which enters it in winter, and the small influence of the warm winds in summer, than on the absolute elevation of the cavity, and the mean temperature of the layer of air in which it is situated. The air contained in the interior of a mountain is not easily displaced, as is exemplified by Monte Testaccio at Rome, the temperature of which is so different from that of the surrounding atmosphere. On Chimborazo enormous heaps of ice are found
covered with sand, and, in the same manner as at the peak, far below the inferior limit of the perpetual snows.
It was near the Ice-Cavern (Cueva del Hielo), that, in the voyage of Lapérouse, Messrs. Lamanon and Mongès made their experiments on the temperature of boiling water. These naturalists found it $88.7^{\circ}$, the barometer at nineteen inches one line. In the kingdom of New Grenada, at the chapel of Guadaloupe, near Santa-Fe de Bogotá, I have seen water boil at $89 \cdot 9^{\circ}$, under a pressure of 19 inches 1.9 lines. At Tambores, in the province of Popayan, Señor Caldas found the heat of boiling water $89 \cdot 5^{\circ}$, the barometer being at 18 inches 11.6 lines. These results might lead us to suspect, that, in the experiment of M. Lamanon, the water had not reached the maximum of its temperature.

Day was beginning to dawn when we left the ice-cavern. We observed, during the twilight, a phenomenon which is not unusual on high mountains, but which the position of the volcano we were scaling rendered very striking. A layer of white and fleecy clouds concealed from us the sight of the ocean, and the lower region of the island. This layer did not appear above 800 toises high; the clouds were so uniformly spread, and kept so perfect a level, that they wore the appearance of a vast plain covered with snow. The colossal pyramid of the peak, the volcanic summits of Lancerota, of Forteventura, and the isle of Palma, were like rocks amidst this vast sea of vapours, and their black tints were in fine contrast with the whiteness of the clouds.

While we were climbing over the broken lavas of the Malpays, we perceived a very curious optical phenomenon, which lasted eight minutes. We thought we saw on the east side small rockets thrown into the air. Luminous points, about seven or eight degrees above the horizon, appeared first to move in a vertical direction; but their motion was gradually changed into a horizontal oscillation. Our fellow-travellers, our guides even, were astonished at this phenomenon, without our having made any remark on it to them. We thought, at first sight, that these luminous points, which floated in the air, indicated some new eruption of the great volcano of Lancerota; for we recollected that Bouguer and La Condamine, in scaling the volcano of Pichincha, were witnesses of the eruption of Cotopaxi. But
the illusion soon ceased, and we found that the luminous points were the images of several stars magnified by the vapours. These images remained motionless at intervals, they then seemed to rise perpendicularly, descended sideways, and returned to the point whence they had departed. This motion lasted one or two seconds. Though we had no exact means of measuring the extent of the lateral shifting, we did not the less distinctly observe the path of the luminous point. It did not appear double from an effect of mirage, and left no trace of light behind. Bringing, with the telescope of a small sextant by Troughton, the stars into contact with the lofty summit of a mountain in Lancerota, I observed that the oscillation was constantly directed towards the same point, that is to say, towards that part of the horizon where the disk of the sun was to appear; and that, making allowance for the motion of the star in its declination, the image returned always to the same place. These appearances of lateral refraction ceased long before daylight rendered the stars quite invisible. I have faithfully related what we saw during the twilight, without undertaking to explain this extraordinary phenomenon, of which I published an account in Baron Zach's Astronomical Journal, twelve years ago. The motion of the vesicular vapours, caused by the rising of the sun; the mingling of several layers of air, the temperature and density of which were very different, no doubt contributed to produce an apparent movement of the-stars in the horizontal direction. We see something similar in the strong undulations of the solar disk, when it cuts the horizon; but these undulations seldom exceed twenty seconds, while the lateral motion of the stars, observed at the peak, at more than 1800 toises, was easily distinguished by the naked eye, and seemed to exceed all that we have thought it possible to consider hitherto as the effect of the refraction of the light of the stars. On the top of the Andes, at Antisana, I observed the sun-rise, and passed the whole night at the height of 2100 toises, without noting any appearance resembling this phenomenon.

I was anxious to make an exact observation of the instant of sun-rising at an elevation so considerable as that we had reached on the peak of Teneriffe. No traveller, furnished
with instruments, had as yet taken such an observation. I had a telescope and a chronometer, which I knew to be exceedingly correct. In the part where the sun was to appear the horizon was free from vapour. We perceived the upper limb at $4^{h} 48^{\prime} 55^{\prime \prime}$ apparent time, and what is very remarkable, the first luminous point of the disk appeared immediately in contact with the limit of the horizon, consequently we saw the true horizon; that is to say, a part of the sea farther distant than 43 leagues. It is proved by calculation that, under the same parallel in the plain, the rising would have began at $5^{\text {h }} 1^{\prime} 50 \cdot 4^{\prime \prime}$, or $11^{\prime} 51 \cdot 3^{\prime \prime}$ later than at the height of the peak. The difference observed was $12^{\prime} 55^{\prime \prime}$, which arose no doubt from the uncertainty of the refraction for a zenith distance, of which observations are wanting.

We were surprised at the extreme slowness with which the lower limb of the sun seemed to detach itself from the horizon. This limb was not visible till $4^{\text {h }} 56^{\prime} 56^{\prime \prime}$. The dise of the sun, much flattened, was well defined; during the ascent there was neither double image nor lengthening of the lower limb. The duration of the sun's rising being triple that which we might have expected in this latitude, we must suppose that a fog-bank, very uniformly extended, concealed the true horizon, and followed the sun in its ascent. Notwithstanding the libration of the stars,* which we had observed towards the east, we could not attribute the slowness of the rising to an extraordinary refraction of the rays occasioned by the horizon of the sea; for it is precisely at the rising of the sun, as Le Gentil daily observed at Pondicherry, and as I have several times remarked at Cumana, that the horizon sinks, on account of the elevation of temperature in the stratum of the air which lies immediately over the surface of the ocean.

The road, which we were obliged to clear for ourselves across the Malpays, was extremely fatiguing. The ascent is steep, and the blocks of lava rolled from beneath our feet. I can compare this part of the road only to the Moraine of the

[^18]Alps or that mass of pebbly stones which we find at the lower extremity of the glaciers. At the peak the lava, broken into sharp pieces, leaves hollows, in which we risked falling up to our waists. Cnfortunately the listlessness of our guides contributed to increase the difficulty of this ascent. Unlike the guides of the valley of Chamouni, or the nimble-footed Guanches, who could, it is asserted, seize the rabbit or wild goat in its course, our Canarian guides were models of the phlegmatic. They had wished to persuade us on the preceding evening not to go beyond the station of the rocks. Every ten minutes they sat down to rest themselves, and when unobserved they threw away the specimens of obsidian and pumice-stone, which we had carefully collected. We discovered at length that none of them had ever visited the summit of the volcano.

After three hours' walking, we reached, at the extremity of the Malpays, a small plain, called La Rambleta, from the centre of which the Piton, or Sugar-loaf, takes its rise. On the side toward Orotava the mountain resembles those pyramids with steps that are seen at Fayoum and in Mexico; for the elevated plains of Retama and Rambleta form two tiers, the first of which is four times higher than the second. If we suppose the total height of the Peak to be 1904 toises, the Rambleta is 1820 toises above the level of the sea. Here are found those spiracles, which are called by the natives the Nostrils of the Peak (Narices del Pico). Watery and heated vapours issue at intervals from severak crevices in the ground, and the thermometer rose to $43.2^{\circ}$; M. Labillardière had found the temperature of these vapours, eight years before us, $53 \cdot 7^{\circ}$; a difference which does not perhaps prove so much a diminution of activity in the volcano, as a local change in the heating of its internal surface. The vapours have no smell, and seem to be pure water. A short time before the great eruption of Mount Vesuvius, in 1805, M. Gay-Lussac and myself had observed that water, under the form of vapour, in the interior of the crater, did not redden paper which had been dipped in syrup of violets. I cannot, however, admit the bold hypothesis, according to which the Nostrils of the Peak are to be considered as the vents of an immense apparatus of distillation, the lower part of which is situated below the level of the sea. Since
the time when volcanoes have been carefully studied, and the love of the marvellous has been less apparent in works on geology, well founded doubts have been raised respecting these direct and constant communications between the waters of the sea and the focus of the volcanic fire.* We may find a very simple explanation of a phenomenon, that has in it nothing very surprising. The peak is covered with snow during part of the year; we ourselves found it still so in the plain of Rambleta. Messrs. O'Donnel and Armstrong discovered in 1806 a very abundant spring in the Malpays, a hundred toises above the cavern of ice, which is perhaps fed partly by this snow. Everything consequently leads us to presume that the peak of Teneriffe, like the volcanoes of the Andes, and those of the island of Manilla, contains within itself great cavities, which are filled with atmospherical water, owing merely to filtration. The aqueous vapours exhaled by the Narices and crevices of the crater, are only those same waters heated by the interior surfaces down which they flow.
We had yet to scale the steepest part of the mountain, the Piton, which forms the summit. The slope of this small cone, covered with volcanic ashes, and fragments of pumicestone, is so steep, that it would have been almost impossible to reach the top, had we not ascended by an old current of lava, the débris of which have resisted the ravages of time. These débris form a wall of scorious rock, which stretches into the midst of the loose ashes. We ascended the Piton by grasping these half-decomposed scorix, which often broke in our hands. We employed nearly half an hour to scale a hill, the perpendicular height of which is scarcely ninety toises. Vesuvius, three times lower than the peak of Teneriffe, is terminated by a cone of ashes almost three times higher, but with a more accessible and easy slope. Of all

[^19]the volcanves which I have visited, that of Jorullo, in Mexico, is the only one that is more difficult to climb than the Peak, because the whole mountain is covered with loose ashes.

When the Sugar-loaf (el Piton) is covered with snow, as it is in the beginning of winter, the steepness of its declivity may be very dangerous to the traveller. M. Le Gros showed us the place where captain Baudin was nearly killed when he visited the Peak of Teneriffe. That officer had the courage to undertake, in company with the naturalists Advenier, Mauger, and Riedlé, an excursion to the top of the volcano about the end of December, 1797. Having reached half the height of the cone, he fell, and rolled down as far as the small plain of Rambleta; happily a heap of lava, covered with snow, hindered him from rolling farther with accelerated velocity. I have been told, that in Switzerland a traveller was suffocated by rolling down the declivity of the Col de Balme, over the compact turf of the Alps.

When we gained the summit of the Piton, we were surprised to find scarcely room enough to seat ourselves conveniently. We were stopped by a small circular wall of porphyritic lava, with a base of pitchstone, which concealed from us the view of the crater.* The west wind blew with such violence that we could scarcely stand. It was eight in the morning, and we suffered severely from the cold, though the thermometer kept a little above freezing point. For a long time we had been accustomed to a very high temperature, and the dry wind increased the feeling of cold, because it carried off every moment the small atmosphere of warm and humid air, which was formed around us from the effect of cutaneous perspiration.

The brink of the crater of the peak bears no resemblance to those of most of the other volcanoes which I have visited: for instance, the craters of Vesuvius, Jorullo, andPichincha. In these the Piton preserves its conic figure to the very summit: the whole of their declivity is inclined the same number of degrees, and uniformly covered with a layer of pumice-stone very minutely divided; when we reach

* Called La Caldera, or the caldrun of the peak, a denomination which recals to mind the Oules of the Prrences.
the top of these volcanoes, nothing obstructs the view of the bottom of the crater. The peaks of Teneriffe and Cotopaxi, on the contrary, are of very different construction. At their summit a circular wall surrounds the crater; which wall, at a distance, has the appearance of a small cylinder placed on a truncated cone. On Cotopaxi this peculiar construction is risible to the naked eye at more than 2,000 toises distance; and no person has ever reached the crater of that volcano. On the peak of Teneriffe, the wall, which surrounds the crater like a parapet, is so high, that it would be impossible to reach the Caldera, if, on the eastern side, there was not a breach, which seems to have been the effect of a flowing of very old lava. We descended through this breach toward the bottom of the funnel, the figure of which is elliptic. Its greater axis has a direction from north-west to south-east, nearly $\mathrm{N} .35^{\circ} \mathrm{W}$. The greatest breadth of the mouth appeared to us to be 300 feet, the smallest 200 feet, which numbers agree very nearly with the measurement of MM. Verguin, Varela, and Borda.
It is easy to conceive, that the size of a crater does not depend solely on the height and mass of the mountain, of which it forms the principal air-vent. This opening is indeed seldom in direct ratio with the intensity of the volcanic fire, or with the activity of the volcano. At Vesurius, which is but a hill compared with the Peak of Teneriffe, the diameter of the crater is five times greater. When we reflect, that very lofty volcanoes throw out less matter from their summits than from lateral openings, we should be led to think, that the lower the volcanoes, their force and activity being the same, the more considerable ought to be their craters. In fact, there are immense volcanoes in the Andes, which have but very small openings; and we might establish as a geological principle, that the most colossal mountains have craters of little extent at the summits, if the Cordilleras did not present many instances to the contrary.* I shall have occasion, in the progress of this work, to cite a number of facts, which will throw some light on what may be called the external structure of volcanoes. This structure is as varied

[^20]as the volcanic phenomena themselves; and in order to raise ourselves to geological conceptions worthy of the greatness of nature, we must set aside the idea that all volcanoes are formed after the model of Vesuvius, Stromboli, and Etna.

The external edges of the Caldera are almost perpendicular. Their appearance is somewhat like the Somma, seen from the Atrio dei Cavalli. We descended to the bottom of the crater on a train of broken lava, from the eastern breach of the enclosure. The heat was perceptible only in a few crevices, which gave vent to aqueous vapours with a peculiar buzzing noise. Some of these funnels or crevices are on the outside of the enclosure, on the external brink of the parapet that surrounds the crater. We plunged the thermometer into them, and saw it rise rapidly to 68 and 75 degrees. It no doubt indicated a higher temperature, but we could not observe the instrument till we had drawn it up, lest we should burn our hands. M. Cordier found several crevices, the heat of which was that of boiling water. It might be thought that these vapours, which are emitted in gusts, contain muriatic or sulphurous acid; but when condensed, they have no particular taste; and experiments, which have been made with re-agents, prove that the chimneys of the peak exhale only pure water. This phenomenon, analogous to that which I observed in the crater of Jorullo, deserves the more attention, as muriatic acid abounds in the greater part of volcanoes, and as M. Vauquelin has discovered it even in the porphyritic lavas of Sarcouy in Auvergne.

I sketched on the spot a view of the interior edge of the crater, as it presented itself in the descent by the eastern break. Nothing is more striking than the manner in which these strata of lava are piled on one another, exhibiting the sinuosities of the calcareous rock of the higher Alps. These enormous ledges, sometimes horizontal, sometimes inclined and undulating, are indicative of the ancient fluidity of the whole mass, and of the combination of several deranging causes, which have determined the direction of each flow. The top of the circular wall exhibits those curious ramifications which we find in coke. The northern edge is most elevated. Towards the south-west the enclosure is considerably sunk, and an enormous mass of scorious lava seems
glued to the extremity of the brink. On the west the rock is perforated; and a large opening gives a view of the horizon of the sea. The force of the elastic vapours perhaps formed this natural aperture, at the time of some inundation of lava thrown out from the crater.
The inside of this funnel indicates a volcano, which for thousands of years has vomited no fire but from its sides. This conclusion is not founded on the absence of great openings, which might be expected in the bottom of the Caldera. Those whose experience is founded on personal observation, know that several volcanoes, in the intervals of an eruption, appear filled up, and almost extinguished; but that in these same mountains, the crater of the volcano exhibits layers of scorim, rough, sonorous, and shining. We observe hillocks and intumescences caused by the action of the elastic vapours, cones of broken scorix, and ashes which cover the funnels. None of these phenomena characterise the crater of the peak of Teneriffe ; its bottom is not in the state which ensues at the close of an eruption. From the lapse of time, and the action of the vapours, the inside walls are detached, and have covered the basin with great blocks of lithoid lavas.
The bottom of the Caldera is reached without danger. In a volcano, the activity of which is principally directed towards the summit, such as Vesurius, the depth of the crater varies before and after each eruption; but at the peak of Teneriffe the depth appears to have remained unchanged for a long time. Eden, in 1715, estimated it at 115 feet; Cordier, in 1803, at 110 feet. Judging by mere inspection, I should have thought the funnel of still less depth. Its present state is that of a solfatara; and it is rather an object of curious investigation, than of imposing aspect. The majesty of the site consists in its elevation above the level of the sea, in the profound solitude of these lofty regions, and in the immense space over which the eye ranges from. the summit of the mountain.

The wall of compact lava, forming the enclosure of the Caldera, is snow-white at its surface. The same colour prevails in the inside of the Solfatara of Puzzuoli. When we break these lavas, which might be taken at some distance for calcareous stone, we find in them a blackish brown nucleus. Porphyry, with basis of pitch-stone, is whitened
externally by the slow action of the vapours of sulphurous acid gas. These vapours rise in abundance; and what is rather remarkable, through crevices which seem to have no communication with the apertures that emit aqueous vapours. We may be convinced of the presence of the sulphurous acid, by examining the fine crystals of sulphur, which are everywhere found in the crevices of the lava. This acid, combined with the water with which the soil is impregnated, is transformed into sulphuric acid by contact with the oxygen of the atmosphere. In general, the humidity in the crater of the peak is more to be feared than the heat; and they who seat themselves for a while on the ground find their clothes corroded. The porphyritic lavas are affected by the action of the sulphuric acid: the alumine, magnesia, soda, and metallic oxides gradually disappear; and often nothing remains hut the silex,' which unites in mammillary plates, like opal. These siliceous concretions,* which M. Cordier first made known, are similar to those found in the isle of Ischia, in the extinguished volcanoes of Santa Fiora, and in the Solfatara of Puzzuoli. It is not easy to form an idea of the origin of these incrustations. The aqueous vapours, discharged through great spiracles, do not contain alkali in solution, like the waters of the Geyser, in Iceland. Perhaps the soda contained in the lavas of the peak acts an important part in the formation of these deposits of silex. There may exist in the crater small crevices, the vapours of which are not of the same nature as those on which travellers, whose attention has been directed simultaneously to a great number of objects, have made experiments.

Seated on the northern brink of the crater, I dug a hole of some inches in depth; and the thermometer placed in this hole rose rapidly to $42^{\circ}$. Hence we may conclude what must be the heat in this solfatara at the depth of thirty or forty fathoms. The sulphur reduced into vapour is condensed into fine crystals, which however are not equal in size to those M. Dolomieu brought from Sicily. They are semidiaphanous octohedrons, very brilliant on the surface, and of

[^21]a conchoidal fracture. These masses, which will one day perhaps be objects of commerce, are constantly bedewed with sulphurous acid. I had the imprudence to wrap up a few, in order to preserve them, but I soon discovered that the acid had consumed not only the paper which contained them, but a part also of my mineralogical journal. The heat of the vapours, which issue from the crevices of the caldera, is not sufficiently great to combine the sulphur while in a state of minute division, with the oxygen of the atmospheric air ; and after the experiment I have just cited on the temperature of the soil, we may presume that the sulphurous acid is formed at a certain depth,* in cavities to which the external air has free access.
The vapours of heated water, which act on the fragments of lava scattered about on the caldera, reduce certain parts of it to a state of paste. On examining, after I had reached America, those earthy and friable masses, I found crystals of sulphate of alumine. MM. Davy and Gay-Lussac have already made the ingenious remark, that two bodies highly inflammable, the metals of soda and potash, have probably an important part in the action of a volcano; now the potash necessary to the formation of alum is found not only in feldspar, mica, pumice-stone, and augite, but also in obsidian. This last substance is very common at Teneriffe, where it forms the basis of the tephrinic lava. These analogies between the peak of Teneriffe and the Solfatara of Puzzuoli, might no doubt be shown to be more numerous, if the former were more accessible, and had been frequently visited by naturalists.

An expedition to the summit of the volcano of Teneriffe is interesting, not solely on account of the great number of phenomena which are the objects of scientific research; it has still greater attractions from the picturesque beauties which it lays open to those who are feelingly alive to the majesty of nature. It is a difficult task to describe the

* An observer, in general very accurate, M. Breislack, asserts that the muriatic acid always predominates in the vapours of Vesuvius. This assertion is contrary to what M. Gay-Lussac and myself observed, before the great eruption of 1805, and while the lava was issuing from the crater. The smell of the sulphurous acid, so easy to distinguish, was perceptible at a great distance; and when the volcano threw out scoriæ, the smell was mingled with that of petroleum.
sensations, which are the more forcible, inasmuch as they have something undefined, produced by the immensity of the space as well as by the vastness, the novelty, and the multitude of the objects, amidst which we find ourselves transported. When a traveller attempts to describe the loftiest summits of the globe, the cataracts of the great rivers, the tortuous vallies of the Andes, he incurs the danger of fatiguing his readers by the monotonous expression of his admiration. It appears to me more conformable to the plan I have proposed to myself in this narrative, to indicate the peculiar character that distinguishes each zone: we exhibit with more clearness the physiognomy of the landscape, in proportion as we endeavour to sketch its individual features, to compare them with each other, and to discover by this kind of analysis the sources of the enjoyments, furnished by the great picture of nature.

Travellers have learned by experience, that views from the summits of very lofty mountains are neither so beautiful, picturesque, nor so varied, as those from heights which do not exceed that of Vesuvius, Righi, and the Puy-de-Dôme. Colossal mountains, such as Chimborazo, Antisana, or Mount Rosa, compose so large a mass, that the plains covered with rich vegetation are seen only in the immensity of distance, and a blue and vapoury tint is uniformly spread over the landscape. The peak of Teneriffe, from its slender form and local position, unites the advantages of less lofty summits with those peculiar to very great heights. We not only discern from its top a vast expanse of sea, but we perceive also the forests of Teneriffe, and the inhabited parts of the coasts, in a proximity calculated to produce the most beautiful contrasts of form and colour. We might say, that the volcano overwhelms with its mass the little island which serves as its base, and it shoots up from the bosom of the waters to a height three times loftier than the region where the clouds float in summer. If its crater, half extinguished for ages past, shot forth flakes of fire like that of Stromboli in the Æolian Islands, the peak of Teneriffe, like a lighthouse, would serve to guide the mariner in a circuit of more than 260 leagues.

When we were seated on the external edge of the crater, we turned our eyes towards the north-west, where the coasts
are studded with villages and hamlets. At our feet, masses of vapour, constantly drifted by the winds, afforded us the most variable spectacle. A uniform stratum of clouds, similar to that already described, and which separated us from the lower regions of the island, had been pierced in several places by the effect of the small currents of air, which the earth, heated by the sun, began to send towards us. The port of Orotava, its vessels at anchor, the gardens and the vineyards encircling the town, shewed themselves through an opening which seemed to enlarge every instant. From the summit of these solitary regions our eyes wandered over an inhabited world; we enjoyed the striking contrast between the bare sides of the peak, its steep declivities covered with scorim, its elevated plains destitute of vegetation, and the smiling aspect of the cultured country beneath. We beheld the plants divided by zones, as the temperature of the atmosphere diminished with the elevation of the site. Below the Piton, lichens begin to cover the scorious and lustrous lava: a violet,* akin to the Viola decumbens, rises on the slope of the volcano at 1740 toises of height; it takes the lead not only of the other herbaceous plants, but even of the gramina, which, in the Alps and on the ridge of the Cordilleras, form close neighbourhood with the plants of the family of the cryptogamia. Tufts of retama, loaded with flowers, adorn the vallies hollowed out by the torrents, and encumbered with the effects of the lateral eruptions. Below the retama, lies the region of ferns, bordered by the tract of the arborescent heaths. Forests of laurel, rhamnus, and arbutus, divide the ericas from the rising grounds planted with vines and fruit trees. A rich carpet of verdure extends from the plain of spartium, and the zone of the alpine plants even to the groups of the date tree and the musa, at the feet of which the ocean appears to roll. I here pass slightly over the principal features of this botanical chart, as I shall enter hereafter into some farther details respecting the geography of the plants of the island of Teneriffe. $\dagger$

The seeming proximity, in which, from the summit of the peak, we behold the hamlets, the vineyards, and the gardens on the coast, is increased by the prodigious transparency of * Viola cheiranthifolia. + See p. 114.

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the atmosphere. Notwithstanding the great distance, we could distinguish not only the houses, the sails of the vessels, and the trunks of the trees, but we could discern the vivid colouring of the vegetation of the plains. These phenomena are owing not only to the height of the site, but to the peculiar modifications of the air in warm climates. In every zone, an object placed on a level with the sea, and viewed in a horizontal direction, appears less luminous, than when seen from the top of a mountain, where vapours arrive after passing through strata of air of decreasing density. Differences equally striking are produced by the influence of climate. The surface of a lake or large river is less resplendent, when we see it at an equal distance, from the top of the higher Alps of Switzerland, than when we view it from the summit of the Cordilleras of Peru or of Mexico. In proportion as the air is pure and serene, the solution of the vapours becomes more complete, and the light loses less in its passage. When from the shores of the Pacific we ascend the elevated plain of Quito, or that of Antisana, we are struck for some days by the nearness at which we imagine we see objects which are actually seven or eight leagues distant. The peak of Teyde has not the advantage of being situated in the equinoctial region; but the dryness of the columns of air which rise perpetually above the neighbouring plains of Africa, and which the eastern winds convey with rapidity, gives to the atmosphere of the Canary Islands a transparency which not only surpasses that of the air ón Naples and sicily, but perhaps exceeds the purity of the sky of Quito and Peru. This transparency may be re garded as one of the chief causes of the beauty of landscape scenery in the torrid zone; it heightens the splendour of the vegetable colouring, and contributes to the magical effect of its harmonies and contrasts. If the mass of light, which circulates about objects, fatigues the external senses during a part of the day, the inhabitant of the southern climates has his compensation in moral enjoyment. A lucid clearness in the conceptions, and a serenity of mind, correspond with the transparency of the surrounding atmosphere. We feel these impressions without going beyond the boundaries of Europe. I appeal to travellers who have visited countries rendered famous by the great
creations of the imagination and of art,-the favoured climes of Italy and Greece.

We prolonged in vain our stay on the summit of the Peak, awaiting the moment when we might enjoy the view of the whole of the archipelago of the Fortunate Islands:* we, however, descried Palma, Gomera, and the Great Canary, at our feet. The mountains of Lancerota, free from vapours at sunrise, were soon enveloped in thick clouds. Supposing only an ordinary refraction, the eye takes in, in calm weather, from the summit of the volcano, a surface of the globe of 5700 square leagues, equal to a fourth of the superficies of Spain. The question has often been agitated, whether it be possible to perceive the coast of Africa from the top of this colossal pyramid ; but the nearest parts of that coast are still farther from Teneriffe than $2^{\circ} 49^{\prime}$, or 56 leagues. The visual ray of the horizon from the Peak being $1^{\circ} 57^{\prime}$, cape Bojador can be seen only on the supposition of its height being 200 toises above the level of the ocean. We are ignorant of the height of the Black Mountains near cape Bojador, as well as of that peak, called by navigators the Peñon Grande, farther to the south of this promontory. If the summit of the volcano of Teneriffe were more accessible, we should observe without doubt, in certain states of the wind, the effects of an extraordinary refraction. On perusing what Spanish and Portuguese authors relate respecting the existence of the fabulous isle of San Borondon, or Antilia, we find that it is particularly the humid wind from west-south-west, which produces in these latitudes the phenomena of the mirage. We shall not however admit with M. Vieyra, "that the play of the terrestrial refractions may render visible to the inhabitants of the Canaries the islands of Cape Verd, and even the Apalachian mountains of America." $\dagger$

* Of all the small islands of the Canaries, the Rock of the East is the only one which cannot be seen, even in fine weather, from the top of the Peak. Its distance is $3^{\circ} 5^{\prime}$, while that of the Salvage is only $2^{\circ} 1^{\prime}$. The island of Madeira, distant $4^{\circ} 29^{\prime}$, would be visible, if its mountains were more than 3,000 toises high. .
+ The American fruits, frequently thrown by the sea on the coasts of the islands of Ferro and Gomera, were formerly supposed to emanate from the plants of the island of San Borondon. This island, said to be governed by an archbishop and six bishops, and which Father Feijoo believed to be the image of the island of Ferro, reflected on a fog-bank,

The cold we felt on the top of the Peak, was very considerable for the season: The centigrade thermometer, at a distance from the ground, and from the apertures that emitted the hot vapours, fell in the shade to $2 \cdot 7^{\circ}$. The wind was west, and consequently opposite to that which brings to Teneriffe, during a great part of the year, the warm air that floats above the burning desert of Africa. As the temperature of the atmosphere, observed at the port of Orotava by M. Savagi, was $22.8^{\circ}$, the decrement of caloric was one degree every 94 toises. This result perfectly corresponds with those obtained by Lamanon and Saussure on the summits of the Peak and Etna, though in very different seasons. The tall slender form of these mountains facilitates the means of comparing the temperature of two strata of the atmosphere, which are nearly in the same perpendicular plane; and in this point of view the observations made in an excursion to the volcano of Teneriffe resemble those of an ascent in a balloon. We must nevertheless remark, that the ocean, on account of its transparency and evaporation, reflects less caloric than the plains, into the upper regions of the air; and also that summits which are surrounded by the sea are colder in summer, than mountains which rise from a continent; but this circumstance has very little influence on the decrement of atmospherical heat; the temperature of the low regions being equally diminished by the proximity of the ocean.

It is not the same with respect to the influence exercised by the direction of the wind, and the rapidity of the ascending current; the latter sometimes increases in an astonishing manner the temperature of the loftiest mountains. I have seen the thermometer rise, on the slope of the volcano of Antisana, in the kingdom of Quito, to $19^{\circ}$, when we were 2837 toises high. M. Labillardière has seen it, on the edge of the crater of the peak of Teneriffe, at $18.7^{\circ}$, though he had used every possible precaution to avoid the effect of accidental causes.

On the summit of the Peak, we beheld with admiration the azure colour of the sky. Its intensity at the zenith appeared to correspond to $41^{\circ}$ of the cyanometer. We know,
was ceded in the 16th century, by the King of Portugal, to Lewis Perdigon, at the time the latter was preparing to take possession of it by conquest.
by Saussure's experiment, that this intensity increases with the rarity of the air, and that the same instrument marked at the same period $39^{\circ}$ at the priory of Chamouni, and $40^{\circ}$ at the top of Mont Blanc. This last mountain is 540 toises higher than the volcano of Teneriffe; and if, notwithstanding this difference, the sky is observed there to be of a less deep blue, we must attribute this phenomenon to the dryness of the African air, and the proxinity of the torrid zone.

We collected on the brink of the crater ${ }_{2}$ some air which we meant to analyse on our voyage to America. The phial remained so well corked, that on opening it ten days after, the water rushed in with impetuosity. Several experiments, made by means of nitrous gas in the narrow tube of Fontana's eudiometer, seemed to prove that the air of the crater contained $0.09^{\circ}$ less oxygen than the air of the sea; but I have little confidence in this result obtained by means which we now consider as very inexact. The crater of the Peak has so little depth, and the air is renewed with so much facility, that it is scarcely probable the quantity of azote is greater there than on the coasts. We know also, from the experiments of MM. Gay-Lussac and Theodore de Saussure, that in the highest as well as in the lowest regions of the atmosphere, the air equally contains 0.21 of oxygen.*

We saw on the summit of the Peak no trace of psora, lecidea, or other cryptogamous plants; no insect fluttered in the air. We found however a few hymenoptera adhering to masses of sulphur moistened with sulphurous acid, and lining the mouths of the funnels. These are bees, which appear to have been attracted by the flowers of the Spartium nubigenum, and which oblique currents of air had carried up to these high regions, like the butterflies found by M. Ramond at the top of Mont Perdu. The butterflies perished from cold, while the bees on the Peak were scorched on imprudently approaching the crevices where they came in search of warmth.

[^22]Notwithstanding the heat we felt in our feet on the edge of the crater, the cone of ashes remains covered with snow during several months in winter. It is probable, that under the cap of snow considerable hollows are found, like those existing under the glaciers of Switzerland, the temperature of which is constantly less elevated than that of the soil on which they repose. The cold and violent wind, which blew from the time of sunrise, induced us to seek shelter at the foot of the Piton. Our hands and faces were nearly frozen, while our boots were burnt by the soil on which we walked. We descended in the space of a few minates the Sugar-loaf which we had scaled with so much toil; and this rapidity was in part involuntary, for we often rolled down on the ashes. It was with regret that we quitted this solitude, this domain where Nature reigns in all her majesty. We consoled ourselves with the hope of once again visiting the Canary Islands, but this, like many other plans we then formed, has never been executed.

We traversed the Malpays but slowly ; for the foot finds no sure foundation on the loose blocks of lava. Nearer the station of the rocks, the descent becomes extremely difficult; the compact short-swarded turf is so slippery, that we were obliged to incline our bodies continually backward, in order to avoid falling. In the sandy plain of Retama, the thermometer rose to $22.5^{\circ}$; and this heat seemed to us suffocating in comparison with the cold, which we had suffered from the air on the sammit of the volcano. We were absolutely without water ; our gaides, not satisfied with drinking clandestinely the little supply of malmsey wine, for which we were indebted to Don Cologan's kindness, had broken our water jars. Happily the bottle which contained the air of the crater escaped unhurt.

We at length enjoyed the refreshing breeze in the beantiful region of the arborescent erica and fern; and we were enveloped in a thick bed of clouds stationary at six hundred toises above the plain. The clouds having dispersed, we remarked a phenomenon which afterwards became familiar to us on the declivities of the Cordilleras. Small currents of air chased trains of cloud with unequal velocity, and in opposite directions: they bore the appearance of streamlets of water in rapid motion and flowing in all directions, amidst a
great mass of stagnant water. The causes of this partial motion of the clouds are probably very various; we may suppose them to arise from some impulsion at a great dibtance; from the slight inequalities of the soil, which reflects in a greater or less degree the radiant heat; from a difference of temperature kept up by some chemical action; or perhaps from a strong electric charge of the vesicular vapours.

As we approached the town of Orotara, we met great flocks of canaries.* These birds, well known in Europe, were in general uniformly green. Some, however, had a yellow tinge on their backs; their note was the same as that of the tame canary. It is nevertheless remarked, that those which have been taken in the island of the Great Canary, and in the islet of Monte Clara, near Lancerota, have a louder and at the same time a more harmonious song. In every zone, among birds of the same species, each flock has its peculiar note. The yellow canaries are a variety, which has taken birth in Europe ; and those we saw in cages at Orotava and Santa Cruz had been bought at Cadiz, and in other ports of Spain. But of all the birds of the Canary Islands, that which has the most heart-soothing song is unknown in Europe. It is the capirote, which no effort has succeeded in taming, so sacred to his soul is liberty. I have stood histening in admiration of his soft and molodious warbling, in a garden at Orotava; but I have never seen him sufficiently near to ascertain to what family he belongs. As to the parrots, which were supposed to have been seen at the period of captain Cook's abode at Teneriffe, they never existed but in the narratives of a few travellers, who have copied from each other. Neither parrots nor monkeys inhabit the Canary Islands; and though in the New Continent the former migrate as far as North Carolina, I doubt whether in the Old they have ever been met with beyond the 28th degree of north latitude.
Toward the close of day we reached the port of Orotava, where we received the unexpected intelligence that the Pizarro would not set sail till the 24th or 25th. If we could have calculated on this delay, we should either have lengthened

[^23]our stay on the Peak,* or have made an excursion to the volcano of Chahorra. We passed the following day in visiting the environs of Orotava, and enjoying the agreeable comcompany we found at Don Cologan's. We perceived that Teneriffe had attractions not only to those who devote themselves to the study of nature: we found at Orotava several persons possessing a taste for literature and music, and who have transplanted into these distant climes the amenity of European society. In these respects the Canary Islands have no great resemblance to the other Spanish colonies, excepting the Havannah.

We were present on the eve of St. John at a pastoral fete in the garden of Mr. Little. This gentleman, who rendered great service to the Canarians during the last famine, has cultivated a hill covered with volcanic substances. He has formed in this delicious site an English garden, whence there is a magnificent view of the Peak, of the villages along the coast, and the isle of Palma, which is bounded by the vast expanse of the Atlantic. I cannot compare this prospect with any, except the views of the bays of Genoa and Naples; but Orotava is greatly superior to both in the magnitude of the masses and in the richness of vegetation. In the beginning of the evening the slope of the volcano exhibited on a sudden a most extraordinary spectacle. The shepherds, in conformity to a custom, no doubt introduced by the Spaniards, though it dates from the highest antiquity, had lighted the fires of St. John. The scattered masses of fire and the columns of smoke driven by the wind, formed a fine contrast with the deep verdure of the forests which covered the sides of the Peak. Shouts of joy resounding

* As a great number of travellers who land at Santa Cruz, do not undertake the excursion to the Peak, because they are ignorant of the time it occupies, it may be useful to lay down the following data: In making use of mules as far as the Estancia de los Ingleses, it takes twentyone hours from Orotava to arrive at the summit of the Peak, and return to the port; namely, from Orotava to the Pino del Dornajito three hours; from the Pino to the Station of the Rocks six hours; and from this station to the Caldera three hours and a half. I reckon nine hours for the descent. In this calculation I count only the time employed in walking, without reckoning that which is necessary for examining the productions of the Peak, or for taking rest. Half a day is sufficient for going from Santa Cruz to Orotava
from afar were the only sounds that broke the silence of nature in these solitary regions.
Don Cologan's family has a country-house nearer the coast than that I have just mentioned. This house, called La Paz, is connected with a circumstance that rendered it peculiarly interesting to us. M. de Borda, whose death we deplored, was its inmate during his last visit to the Canary Islands. It was in a neighbouring plain that he measured the base, by which he determined the height of the Peak. In this geometrical operation the great dracmna of Orotava served as a mark. Should any well-informed traveller at some future day undertake a new measurement of the volcano with more exactness, and by the help of astronomical repeating circles, he ought to measure the base, not near Orotaval, but near Los Silos, at a place called Bante. According to M. Broussonnet there is no plain near the Peak of greater extent. In herborizing near La Paz we found a great quantity of Lichen roccella on the basaltic rocks bathed by the waters of the sea. The archil of the Canaries is a very ancient branch of commerce; this lichen is however found in less abundance in the island of Teneriffe than in the desert islands of Salvage, La Graciosa, and Alegranza, or even in Canary and Hierro. We left the port of Orotava on the 24th of June.

To avoid disconnecting the narrative of the excursion to the top of the Peak, I have said nothing of the geological observations I made on the structure of this colossal mountain, and on the nature of the volcanic rocks of which it is composed. Before we quit the archipelago of the Canaries, I shall linger for a moment, and bring into one point of view some facts relating to the physical aspect of those countries.
Mineralogists who think that the end of the geology of volcanoes is the classification of lavas, the examination of the crystals they contain, and their description according to their external characters, are generally very well satisfied When they come back from the mouth of a burning volcano. They return loaded with those numerous collections, which are the principal objects of their research. This is not the feeling of those who, without confounding descriptive minerulogy (oryctognosy) with geognosy, endeavour to raise them-
selves to ideas generally interesting, and seek, in the study of nature, for answers to the following questions :-

Is the conical mountain of a volcano entirely formed of liquified matter heaped together by successive eruptions, or does it contain in its centre a nuclens of primitive rocks covered with lava, which are these same rocks altered by fire? What are the affinities which unite the productions of modern volcanoes with the basalts, the phonolites, and those porphyries with bases of feldspar, which are without quartz, and which cover the Cordilleras of Peru and Mexico, as well as the small groups of the Monts Dorés, of Cantal, and of Mézen in France? Has the central nucleus of volcanoes been heated in its primitive position, and raised up, in a softened state, by the force of the elastic vapours, before these fluids communicated, by means of a crater, with the external air? What is the substance, which, for thousands of years, keeps up this combustion, sometimes so slow, and at other times so active? Does this unknown cause act at an immense depth; or does this chemical action take place in secondary rocks lying on granite?

The farther we are from finding a solution of these problems in the numerous works hitherto published on Etna and Vesuvius, the greater is the desire of the traveller to see with his own eyes. He hopes to be more fortunate than those who have preceded him; he wishes to form a precise idea of the geological relations which the volcano and the neighbouring mountains bear to each other: but how often is he disappointed, when, on the limits of the primitive soil, enormous banks of tufa and puzzolana render every observation on the position and stratification impossible! We reach the inside of the crater with less difficulty than we at first expect; we examine the cone from its summit to its base; we are struck with the difference in the produce of each cruption, and with the analogy which still exists between the lavas of the same volcano; but, notwithstanding the care with which we interrogate nature, and the number of partial observations which present themselves at every step, we return from the summit of a burning volcano less satisfied than when we were preparing to visit it. It is after we have studied them on the spot, that the volcanic phenomena
appear still more isolated, more variable, more obscure, then we imagine them when consulting the narratives of travellers.
These reflections occurred to me on descending from the summit of the peak of Teneriffe, the first unextinct volcano I had yet visited. They returned anew whenever, in South America, or in Mexico, I had occasion to examine volcanic mountains. When we reflect how little the labours of mineralogists, and the discoveries in chemistry, have promoted the knowledge of the physical geology of mountains, we cannot help being affected with a painful sentiment ; and this is felt still more strongly by those, who, studying nature in different climates, are more occupied by the problems they have not been able to solve, than with the few results they have obtained.
The peak of Ayadyrma, or of Echeyde, *is a conic and isolated mountain, which rises in an islet of very small circamference. Those who do not take into consideration the whole surface of the globe, believe, that these three circumstances are common to the greater part of volcanoes. They cite, in support of their opinion, Etna, the peak of the Azores, the Solfatara of Guadaloupe, the Trois-Salazes of the isle of Bourbon, and the clusters of volcanoes in the Indian Sea and in the Atlantic. In Europe and in Asia, as far as the interior of the latter continent is known, no burning volcano is situated in the chains of mountains; all being at a greater or less distance from those chains. In the New World, on the contrary, (and this fact deserves the greatest attention,) the volcanoes the most stupendous for their masses form a part of the Cordilleras themselves. The mountains of mica-slate and gneiss in Peru and New Grenada immediately touch the volcanic porphyries of the proPinces of Quito and Pasto. To the south and north of these countries, in Chile and in the kingdom of Guatimala, the active volcanoes are grouped in rows. They are the continuation, as we may say, of the chains of primitive rocks; and if the volcanic fire has broken forth in some plain remote from the Cordilleras, as in mount Sangay and Jorullo, $\dagger$ we

[^24]must consider this phenomenon as an exception to the law, which nature seems to have imposed on these regions. I may here repeat these geological facts, because this presumed isolated situation of every volcano has been cited in opposition to the idea that the peak of Teneriffe, and the other volcanic summits of the Canary Islands, are the remains or a submerged chain of mountains. The observations which have been made on the grouping of volcanoes in America, prove that the ancient state of things represented in the conjectural map of the Atlantic by M. Bory de St. Vincent* is by no means contradictory to the acknowledged laws of nature; and that nothing opposes the supposition that the summits of Porto Santo, Madeira, and the Fortunate Islands, may heretofore have formed, either a distinct range of primitive mountains, or the western extremity of the chain of the Atlas.

The peak of Teyde forms a pyramidal mass like Etna, Tungurahua, and Popocatepetl. This physiognomic character is very far from being common to all volcanoes. We have seen some in the southern hemisphere, which, instead of having the form of a cone or a bell, are lengthened in one direction, having the ridge sometimes smooth, and at others bristled with small pointed rocks. This structure is peculiar to Antisana and Pichincha, two burning mountains of the province of Quito; and the absence of the conic form ought never to be considered as a reason excluding the idea of a volcanic origin. I shall develope, in the progress of this work, some of the analogies, which I think I have perceived between the physiognomy of volcanoes and the antiquity of their rocks. It is sufficient to state, generally speaking, that the summits, which are still subject to eruptions of the greatest violence, and at the nearest periods to each other, are slender peaks of a conic form; that the mountains with lengthened summits, and rugged with small stony

* Whether the traditions of the ancients respecting the Atlantis are founded on historical facts, is a matter totally distinct from the question Whether the archipelago of the Canaries and the adjacent islands are the vestiges of a chain of mountains, rent and sunk in the sea during one of the great convulsions of our globe. I do not pretend to form any opinion in favour of the existence of the Atlantis ; but I endeavour to prove, that the Canaries have no more been created by volcanoes, than the whole body of the smaller Antilles has been formed by madrepores.
masses, are very old volcanoes, and near being extinguished; and that rounded tops, in the form of domes, or bells, indicate those problematic porphyries, which are supposed to have been heated in their primitive position, penetrated by vapours, and forced up in a mollified state, without having ever flowed as real lithoidal lavas. To the first class belong Cotopaxi, the peak of Teneriffe, and the peak of Orizava in Mexico. In the second may be placed Cargueirazo and Pichincha, in the province of Quito; the volcano of Puracey, near Popayan; and perhaps also Hecla, in Iceland. In the third and last we may rank the majestic figure of Chimborazo, and, (if it be allowable to place by the side of that colossus a hill of Europe,) the Great Sarcouy in Auvergne.

In order to form a more exact idea of the external structure of volcanoes, it is important to compare their perpendicular height with their circumference. This, however, cannot be done with any exactness, unless the mountains are isolated, and rising on a plain nearly on a level with the sea. In calculating the circumference of the peak of Teneriffe in a curve passing through the port of Orotava, Garachico, Adexe, and Guimar, and setting aside the prolongations of its base towards the forest of Laguna, and the north-east cape of the island, we find that this extent is more than 54,000 toises. The height of the Peak is consequently one twenty-eighth of the circumference of its basis. M. von Buch found a thirty-third for Vesuvius; and, which perhaps is less certain, a thirty-fourth for Etna.* If the slope of these three volcanoes were uniform from the summit to the base, the peak of Teyde would have an inclination of $12^{\circ} 29^{\prime}$, Vesuvius $12^{\circ} 41^{\prime}$, and Etna $10^{\circ} 13^{\prime}$ : a result which must astonish those who do not reflect on what constitutes an average slope. In a very long ascent, slopes

[^25]of three or four degrees alternate with others which are inclined from 25 to 30 degrees; and the latter only strike our imagination, because we think all the slopes of mountains more steep than they really are. I may cite in support of this consideration the example of the ascent from the port of Vera Cruz to the elevated plain of Mexico. On the eastern slope of the Cordillera a road has been traced, which for ages has not been frequented except on foot, or on the backs of mules. From Encero to the small Indian village of Las Vigas, there are 7500 toises of horizontal distance; and Encero being, according to my barometric measurement, 746 toises lower than Las Vigas, the result, for the mean slope, is only an angle of $5^{\circ} 40^{\circ}$.

In the note at the foot of this page will be seen the results of some experiments I have made on the difficulties arising from the declivities in mountainous countries.*

Isolated volcanoes, in the most distant regions, are very analogous in their structure. At great elevations all have considerable plains, in the middle of which arises a cone perfectly circular. Thus at Cotopaxi the plains of Suniguaicu extend beyond the farm of Pansache. The stony summit of Antisana, covered with eternal snow, forms an islet in the midst of an immense plain, the surface of which is twelve leagues square, while its height exceeds that of the peak of Teneriffe by two hundred toises. At Vesuvius,

* In places where there were at the same time slopes covered with tufted grass and loone sands, I took the following measures :-
$5^{\circ}$, slope of a very marked inclination. In France the high roads must not exceed $4^{\circ} 46^{\prime}$ by law;
$15^{\circ}$, slope extremely steep, and which we cannot descend in a carriage ;
$37^{\circ}$, slope almost inaccessible on foot, if the ground be naked rock, or turf too thick to form steps. The body falls backwards when the tibia fakes a smaller angle than $53^{\circ}$ with the sole of the foot;
$42^{\circ}$, the steepest slope that can be climbed on foot in a ground that is sandy, or covered with volcanic ashes.
When the slope is $44^{\circ}$, it is almost impossible to scale it, though the ground permits the forming of steps by thrusting in the foot. The cones of volcanoes have a medium slope from $33^{\circ}$ to $40^{\circ}$. The steepest parts of these cones, either of Vesuvius, the Peak of Teneriffe, the volcano of Pichincha, or Jorullo, are from $40^{\circ}$ to $42^{\circ}$. A slope of $55^{\circ}$ is quite inaccessible. If seen from above it would be estimated at $75^{\circ}$.
at three hundred and seventy toises high, the cone detaches itself from the plain of Atrio dei Cavalli. The peak of Teneriffe presents two of these elevated plains, the uppermost of which, at the foot of the Piton, is as high as Etna, and of very little extent; while the lowermost, covered with tufts of retama, reaches as far as the Estancia de los Ingleses. This rises above the level of the sea almost as high as the city of Quito, and the summit of Mount Lebanon.
The greater the quantity of matter that has issued from the crater of a mountain, the more elevated is its cone of ashes in proportion to the perpendicular height of the volcano itself. Nothing is more striking, under this point of view, than the difference of structure between Vesuvius, the peak of Teneriffe, and Pichincha. I have chosen this last volcano in preference, because its summit* enters scarcely within the limit of the perpetual snows. The cone of Cotopaxi, the form of which is the most elegant and most regular known, is 540 toises in height; but it is impossible to decide whether the whole of this mass is covered with ashes.

| Names of the volcanoes. | Total height in toises. | Height of the cone covered with ashes. | Proportion of the cone to the total height. |
| :---: | :---: | :---: | :---: |
| Vesurias - . | 606 | 200 | $\pm$ |
| Peak of Teneriffe - | 1904 | 84 | $\pm$ |
| Fichinctra | 2490 | 240 | $\frac{18}{17}$ |

This table seems to indicate, what we shall have an opportunity of proving more amply hereafter, that the peak of Teneriffe belongs to that group of great volcanoes, which, like Etna and Antisana, have had more copious eruptions from their sides than from their summits. Thus the crater at the extremity of the Piton, which is called the Caldera,

[^26]is extremely small. Its diminutive size struck M. de Borda, and other travellers, who took little interest in geological investigations.

As to the nature of the rocks which compose the soil of Teneriffe, we must first distinguish between productions of the present volcano, and the range of basaltic mountains which surround the Peak, and which do not rise more than five or six hundred toises above the level of the ocean. Here, as well as in Italy, Mexico, and the Cordilleras of Quito, the rocks of trap-formation* are at a distance from the recent currents of lava; everything shows that these two classes of substances, though they owe their origin to similar phenomena, date from very different periods. It is important to geology not to confound the modern currents of lava, the heaps of basalt, green-stone, and phonolite, dispersed over the primitive and secondary formations, with those porphyroid masses having bases of compact feldspar, $\dagger$ which perhaps have never been perfectly liquified, but which do not less belong to the domain of volcanoes.

In the island of Teneriffe, strata of tufa, puzzolana, and clay, separate the range of basaltic hills from the currents of recent lithoid lava, and from the eruptions of the present volcano. In the same manner as the eruptions of Epomeo in the island of Ischia, and those of Jorullo in Mexico, have taken place in countries covered with trappean porphyry, ancient basalt, and volcanic ashes, so the peak of Teyde has raised itself amidst the wrecks of submarine volcanoes. Notwithstanding the difference of composition in the recent lavas of the Peak, there is a certain regularity of position, which must strike the naturalist least skilled in geognosy. The great elevated plain of Retama separates the black, basaltic, and earthlike lava, from the vitreous and feldsparry

[^27]lava, the basis of which is obsidian, pitch-stone, and phonolite. This phenomenon is the more remarkable, inasmuch as in Bohemia and in other parts of Europe, the porphyrschiefer with base of phonolite* covers also the convex summits of basaltic mountains.
It has already been observed, that from the level of the sea to Portillo, and as far as the entrance on the elevated plain of the Retama, that is, two-thirds of the total height of the volcano, the ground is so covered with plants, that it is diffcult to make geological observations. The currents of lava, which we discover on the slope of Monte Verde, between the beautiful spring of Dornajito and Caravela, are black masses, altered by decomposition, sometimes porous, and with very oblong pores. The basis of these lower lavas is rather wacke than basalt; when it is spongy, it resembles the amygdaloids $\dagger$ of Frankfort-on-the-Maine. Its fracture is generally irregular; wherever it is conchoidal, we may presume that the cooling has been more rapid, and the mass has been exposed to a less powerful pressure. These currents of lava are not divided into regular prisms, but into very thin layers, not very regular in their inclination; they contain much olivine, small grains of magnetic iron, and augite, the colour of which often varies from deep leekgreen to olive green, and which might be mistaken for crystallized olivine, though no transition from one to the other of these substances exists. $\ddagger$ Amphibole is in general very rare at Teneriffe, not only in the modern lithoid lavas, but also in the ancient basalts, as has been observed by M. Cordier, who resided longer at the Canaries than any other mineralogist. Nepheline, leucite, idocrase, and meionite have not yet been seen at the peak of Teneriffe; for a reddish-gray lava, which we found on the slope of Monte Verde, and which contains small microscopic crystals, appears to me to be a close mixture of basalt and anal-

- Klingstein. Werner.
$\dagger$ Wakkenartiger mandelstein. Steinkaute.
$\ddagger$ Steffens, Handbuch der Oryktognosie, tom. i, s. 364. The crystals which Mr. Friesleben and myself have made known under the denomination of foliated olivine (blättriger olivin) belong, according to Mr. Karsten, to the pyroxene augite. Journal des Mines de Freiberg, 1791, p. 215.

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cime. In like manner the lava of Scala, with which the city of Naples is paved, contains a close mixture of basalt, nepheline, and leucite. With respect to this last substance, which has hitherto been observed only at Vesuvius and in the environs of Rome, it exists perhaps at the peak of Teneriffe, in the old currents of lava now covered by more recent ejections. Vesuvias, during a long series of years, has also thrown out lavas without leucites: and if it be true, as M. von Buch has rendered very probable, that these crystals are formed only in the currents which flow either from the crater itself, or very near its brink, we must not be surprised at not finding them in the lavas of the peak. The latter almost all proceed from lateral eruptions, and consequently have been exposed to an enormous pressure in the interior of the volcano.

In the plain of Retama, the basaltic lavas disappear under heaps of ashes, and pumice-stone reduced to powder. Thence to the summit, from 1,500 to 1,900 toises in height, the volcano exhibits only vitreous lava with bases of pitch-stone $\dagger$ and obsidian. These lavas, destitute of amphibole and mica, are of a blackish brown, often varying to the deepest olive green. They contain large crystals of feldspar, which are not fissured, and seldom vitreous. The analogy of those decidedly volcanic masses with the resinite porphyries $\ddagger$ of the valley of Tribisch in Saxony is very remarkable; but the latter, which belong to an extended and metalliferous formation of porphyry, often contain quartz, which is wanting in the modern lavas. When the basis of the lavas of the Malpays changes from pitchstone to obsidian, its colour is paler, and is mixed with gray; in this case, the feldspar passes by imperceptible gradations from the common to the vitreous. Sometimes both varieties meet in the same fragment, as we observed also in the trappean porphyries of the valley of Mexico. The feldsparry lavas of the Peak, of a much less black tinge than those of Arso in the island of
*This substance, which M. Dolomieu discovered in the amygdaloids of Catania in Sicily, and which accompanies the stilbites of Fassa in Tyrol, forms, with the chabasie of Haüy, the genus Cubicit of Werner. M. Cordier found at Teneriffe xeolite in an amygdaloid which covers the basalts of La Punta di Naga.
$\dagger$ Petrosilex resinite. Haliy. $\ddagger$ Pechstein-porphyr. Werner.

Ischia, whiten at the edge of the crater from the effect of the acid vapours; but internally they are not found to be colourless like that of the feldsparry lavas of the Solfatara at Naples, which perfectly resemble the trappean porphyries at the foot of Chimborazo. In the middle of the Malpays, at the height of the cavern of ice, we found among the vitreous lavas with pitch-stone and obsidian bases, blocks of real greenish-gray, or mountain-green phonolite, with a smooth fracture, and divided into thin laminæ, sonorous and keen edged. These masses were the same as the porphyrschiefer of the mountain of Bilin in Bohemia; we recognised in them small long crystals of vitreous feldspar.

This regular disposition of lithoid basaltic lava and feldsparry vitreous lava is analogous to the phenomena of all trappean mountains; it reminds us of those phonolites lying in very ancient basalts, those close mixtures of augite and feldspar which cover the hills of wacke or porous amygdaloids: but why are the porphyritic or feldsparry lavas of the Peak found only on the summit of the volcano? Should we conclude from this position that they are of more recent formation than the lithoid basaltic lava, which contains olivine and augite? I cannot admit this last hypothesis; for lateral eruptions may have covered the feldsparry nucleus, at a period when the crater had ceased its activity. At Vesuvius also, we perceive small crystals of vitreous feldspar only in the very ancient lavas of the Somma. These lavas, setting aside the leucite, very nearly resemble the phonolitic ejections of the Peak of Teneriffe. In general, the farther we go back from the period of modern eruptions, the more the currents increase both in size and extent, acquiring the character of rocks, by the regularity of their position, by their division into parallel strata, or by their independence of the present form of the ground.

The Peak of Teneriffe is, next to Lipari, the volcano that has produced most obsidian. This abundance is the more striking, as in other regions of the earth, in Iceland, in Hungary, in Mexico, and in the kingdom of Quito, we meet with obsidians only at great distances from burning volcanoes. Sometimes they are scattered over the fields in angular pieces; for instance, near Popayan, in South America; at other times they form isolated rocks, as at Quinche, near H 2

Quito. In other places (and this circumstance is very remarkable), they are disseminated in pearl-stone, as at Cinapecuaro, in the province of Mechoacan," and at the Cabo de Gates, in Spain. At the peak of Teneriffe the obsidian is not found towards the base of the volcano, which is covered with modern lava: it is frequent only towards the summit, especially from the plain of Retama, where very fine specimens may be collected. This peculiar position, and the circumstance that the obsidian of the Peak has been ejected by a crater which for ages past has thrown out no flames, favour the opinion, that volcanic vitrifications, wherever they are found, are to be considered as of very ancient formation.

Obsidian, jade, and Lydian-stone, $\dagger$ are three minerals, which nations ignorant of the use of copper or iron, have in all ages employed for making keen-edged weapons. We see that wandering hordes have dragged with them, in their distant journeys, stones, the natural position of which the mineralogist has not yet been able to determine. Hatchets of jade, covered with Aztec hieroglyphics, which I brought from Mexico, resemble both in their form and nature those made use of by the Gauls, and those we find among the South Sea islanders. The Mexicans dug obsidian from mines, which were of vast extent; and they employed it for making knives, sword-blades, and razors. In like mauner the Guanches, (in whose language obsidian was called tabona,) fixed splinters of that mineral to the ends of their lances They carried on a considerable trade in it with the neighbouring islands; and from the consumption thus occasioned, and the quantity of obsidian which must have been broken in the course of manufacture, we may presume that this mineral has become scarce from the lapse of ages. We are surprised to see an Atlantic nation substituting, like the natives of America, vitrified lava for iron. In both countries this variety of lava was employed as an object of ornament: and the inhabitants of Quito made beautiful lookingglasses with an obsidian divided into parallel laminæ.

There are three varieties of obsidian at the Peak. Some form enormous blocks, several toises long, and often of a spheroidal shape. We might suppose that they had been

* To the west of the city of Mexico. $\dagger$ Lydischerstein.
thrown out in a softened state, and had afterwards been subject to a rotary motion. They contain a quantity of vitreous feldspar, of a snow-white colour, and the most brilliant pearly lustre. These obsidians are, nevertheless, but little transparent on the edges; they are almost opaque, of a brownish black, and of an imperfect conchoidal fracture. They pass into pitch-stone; and we may consider them as porphyries with a basis of obsidian. The second variety is found in fragments much less considerable. It is in general of a greenish black, sometimes of murky gray, very seldom of a perfect black, like the obsidian of Hecla and Mexico. Its fracture is perfectly conchoidal, and it is extremely transparent on the edges. I have found in it neither amphibole nor pyroxene, but some small white points, which seem to be feldspar. None of the obsidians of the Peak appear in those gray masses of pearl or lavender-blue, striped, and in separate wedge-formed pieces, like the obsidian of Quito, Mexico, and Lipari, and which resemble the fibrous plates of the crystalites of our glass-houses, on which Sir James Hall, Dr. Thompson, and M. de Bellevue, have published some curious observations.*
The third variety of obsidian of the Peak is the most remarkable of the whole, from its connexion with pumicestone. It is, like that above described, of a greenish black, sometimes of a murky gray, but its very thin plates alternate with layers of pumice-stone. Dr. Thomson's fine collection at Naples contained similar examples of lithoid lava of Vesuvius, divided into very distinct plates, only a line thick. The fibres of the pumice-stone of the Peak are very seldom parallel to each other, and perpendicular to the strata of obsidian ; they are most commonly irregular, asbestoidal, like fibrous glass-gall; and instead of being disseminated in the obsidian, like crystalites, they are found simply adhering to one of the external surfaces of this substance. During my stay at Madrid, M. Hergen showed me several specimens in the mineralogical collection of Don Jose Clavijo; and for

[^28]a long time the Spanish mineralogists considered them as furnishing undoubted proofs, that pumice-stone owes its origin to obsidian, in some degree deprived of colour, and swelled by volcanic fire. I was formerly of this opinion, which, however, must be understood to refer to one variety only of pumice. I even thought, with many other geologists, that obsidian, so far from being vitrified lava, belonged to rocks that were not volcanic; and that the fire, forcing its way through the basalts, the green-stone rocks, the phonolites, and the porphyries with bases of pitchstone and obsidian, the lavas and pumice-stone were no other than these same rocks altered by the action of the volcanoes. The deprivation of colour and extraordinary swelling which the greater part of the obsidians undergo in a forge-fire, their transition into pitch-stone, and their position in regions very distant from burning volcanoes, appear to be phenomena very difficult to reconcile, when we consider the obsidians as volcanic glass. A more profound study of nature, new journeys, and observations made on the productions of burning volcanoes, have led me to renounce those ideas.

It appears to me at present extremely probable, that obsidians, and porphyries with bases of obsidian, are vitrified masses, the cooling of which has been too rapid to change them into lithoid lava. I consider even the pearlstone as an unvitrified obsidian: for among the minerals in the King's cabinet at Berlin there are volcanic glasses from Lipari, in which we see striated crystalites, of a pearl-gray colour, and of an earthy appearance, forming gradual approaches to a granular lithoid lava, like the pearlstone of Cinapecuaro, in Mexico. The oblong bubbles observed in the obsidians of every continent are incontestible proofs of their ancient state of igneous fluidity; and Dr. Thompson possesses specimens from Lipari, which are very instructive in this point of view, because fragments of red porphyry, or porphyry lavas, which do not entirely fill up the cavities of the obsidian, are found enveloped in them. We might say, that these fragments had not time to enter into complete solution in the liquified mass. They contain vitreous feldspar, and augite, and are the same as the celebrated columnar porphyries of the island of Panaria, which, without having been part of a current of lava, seem raised up in the
form of hillocks, like many of the porphyries in Auvergne, in the Euganean mountains, and in the Cordilleras of the Andes.
The objections against the volcanic origin of obsidians, founded on their speedy loss of colour, and their swelling by a slow fire, have been shaken by the ingenious experiments of Sir James Hall. These experiments prove, that a stone which is fusible only at thirty-eight degrees of Wedgwood's pyrometer, yields a glass that softens at fourteen degrees; and that this glass, melted again and unvitrified (glastenized), is fusible again only at thirty-five degree of the same pyrometer. I applied the blowpipe to some black pumice-stone from the volcano of the isle of Bourbon, which, on the slightest contact with the flame, whitened and melted into an enamel.

But whether obsidians be primitive rocks which have undergone the action of volcanic fire, or lavas repeatedly melted within the crater, the origin of the pumice-stones contained in the obsidian of the Peak of Teneriffe is not less problematic. This subject is the more worthy of being investigated, since it is generally interesting to the geology of volcanoes ; and since that excellent mineralogist, M. Fleuriau de Bellevue, after having examined Italy and the adjacent islands with great attention, affirms, that it is highly improbable that pumice-stone owes its origin to the swelling of obsidian.

The experiments of M. da Camara, and those I made in 1802, tend to support the opinion, that the pumice stones adherent to the obsidians of the Peak of Teneriffe do not unite to them accidentally, but are produced by the expansion of an elastic fluid, which is disengaged from the compact vitreous matter. This idea had for a long time occupied the mind of a person highly distinguished for his talents and reputation at Quito, who, unacquainted with the labours of the mineralogists of Europe, had devoted himself to researches on the volcanoes of his country. Don Juan de Larea, one of those men lately sacrificed to the fury of faction, had been struck with the phenomena exhibited by obsidians exposed to a white heat. He had thought, that, wherever volcanoes act in the centre of a country covered with porphyry with base of obsidian, the elastic fluids must cause a swelling of the liquified mass, and perform an important part in
the earthquakes preceding eruptions. Without adopting an opinion, which seems somewhat bold, I made, in concert with M. Larea, a series of experiments on the tumefaction of the volcanic vitreous substances at Teneriffe, and on those which are found at Quinche, in the kingdom of Quito. To judge of the augmentation of their bulk, we measured pieces exposed to a forge-fire of moderate heat, by the water they displaced from a cylindric glass, enveloping the spongy mass with a thin coating of wax. According to our experiments, the obsidians swelled very unequally : those of the Peak and the black varities of Cotopaxi and of Quinche increased nearly five times their bulk.

The colour of the pumice-stones of the Peak leads to another important observation. The sea of white ashes which encircles the Piton, and covers the vast plain of Retama, is a certain proof of the former activity of the crater: for in all volcanoes, even when there are lateral eruptions, the ashes and the rapilli issue conjointly with the vapours only from the opening at the summit of the mountain. Now, at Teneriffe, the black rapilli extend from the foot of the Peak to the sea-shore; while the white ashes, which are only pumice ground to powder, and among which I have discovered, with a lens, fragments of vitreous feldspar and pyroxene, exclusively occupy the region next to the Peak. This peculiar distribution seems to confirm the observations made long ago at Vesuvius, that the white ashes are thrown out last, and indicate the end of the eruption. In proportion as the elasticity of the vapours diminishes, the matter is thrown to a less distance; and the black rapilli, which issue first, when the lava has ceased running, must necessarily reach farther than the white rapilli. The latter appear to have been exposed to the action of a more intense fire.

I have now examined the exterior structure of the Peak, and the composition of its volcanic productions, from the region of the coast to the top of the Piton:-I have endeavoured to render these researches interesting, by comparing the phenomena of the volcano of Teneriffe with those that are observed in other regions, the soil of which is equally undermined by subterranean fires. This mode of viewing Nature in the universality of her relations is no doubt ad-
verse to the rapidity desirable in an itinerary; but it appears to me that, in a narrative, the principal end of which is the progress of physical knowledge, every other consideration ought to be subservient to those of instruction and utility. By isolating facts, travellers, whose labours are in every other respect valuable, have given currency to many false ideas of the pretended contrasts which Nature offers in Africa, in New Holland, and on the ridge of the Cordilleras. The great geological phenomena are subject to regular laws, as well as the forms of plants and animals. The ties which unite these phenomena, the relations which exist between the varied forms of organized beings, are discovered only when we have acquired the habit of viewing the globe as a great whole; and when we consider in the same point of view the composition of rocks, the causes which alter them, and the productions of the soil, in the most distant regions.

Having treated of the volcanic substances of the isle of Teneriffe, there now remains to be solved a question intimately connected with the preceding investigation. Does the archipelago of the Canary Islands contain any rocks of primitive or secondary formation; or is there any production observed, that has not been modified by fire? This interesting problem has been considered by the naturalists of Lord Macartney's expedition, and by those who accompanied captain Baudin in his voyage to the Austral regions. Their opinions are in direct opposition to each other; and the contradiction is the more striking, as the question does not refer to one of those geological reveries which we are accustomed to call systems, but to a positive fact.

Doctor Gillan imagined that he observed, between Laguna and the port of Orotava, in very deep ravines, beds of primitive rocks. This, however, is a mistake. What Dr. Gillan calls somewhat vaguely, mountains of hard ferruginous clay, are nothing but an alluvium which we find at the foot of every volcano. Strata of clay accompany basalts, as tufas accompany modern lavas. Neither M. Cordier nor myself observed in any part of Teneriffe a primitive rock, either in its natural place, or thrown out by the mouth of the Peak; and the absence of these rocks characterizes almost every island of small extent that has an unextinguished volcano. We know nothing positive of the mountains of
the Azores; but it is certain, that the island of Bourbon as well as Teneriffe, exhibits only a heap of lavas and basalts. No volcanic rock rears its head, either on the Gros Morne, or on the volcano of Bourbon, or on the colossal pyramid of Cimandef, which is perhaps more elevated than the Peak of the Canary Islands.

Bory St. Vincent nevertheless asserted, that lavas including fragments of granite have been found on the elevated plain of Retama ; and M. Broussonnet informed me, that on a hill above Guimar, fragments of mica-slate, containing beautiful plates of specular iron, had been found. I can affirm nothing respecting the accuracy of this latter statement, which it would be so much the more important to verify, as M. Poli, of Naples, is in possession of a fragment of rock thrown out by Vesuvius,* which I found to be a real micaslate. Every thing that tends to enlighten us with respect to the site of the volcanic fire, and the position of rocks subject to its action, is highly interesting to geology.

It is possible, that at the Peak of Teneriffe, the fragments of primitive rocks thrown out by the mouth of the volcano may be less rare than they at present appear to be, and may be heaped together in some ravine, not yet visited by travellers. In fact, at Vesuvius, these same fragments are met with only in one single place, at the Fossa Grande, where they are hidden under a thick layer of ashes. If this ravine had not long ago attracted the attention of naturalists, when masses of granular limestone, and other primitive rocks, were laid bare by the rains, we might have thought them as rare at Vesuvius, as they are, at least in appearance, at the Peak of Teneriffe.

[^29]With respect to the fragments of granite, gneiss, and mica-slate, found on the shores of Santa Cruz and Orotava, they were probably brought in ships as ballast. They no more belong to the soil where they lie, than the feldsparry lavas of Etna, seen in the pavements of Hamburgh and other towns of the north. The naturalist is exposed to a thousand errors, if he lose sight of the changes, produced on the surface of the globe by the intercourse between nations. We might be led to say, that man, when expatriating himself, is desirous that everything should change country with him. Not only plants, insects, and different species of small quadrupeds, follow him across the ocean; his active industry covers the shores with rocks, which he has torn from the soil in distant climes.

Though it be certain, that no scientific observer has hitherto found at Teneriffe primitive strata, or even those trappean and ambiguous porphyries, which constitute the bases of Etna, and of several volcanoes of the Andes, we must not conclude from this isolated fact, that the whole archipelago of the Canaries is the production of submarine fires. The island of Gomera contains mountains of granite and mica-slate; and it is, undoubtedly, in these very ancient rocks, that we must seek there, as well as on all other parts of the globe, the centre of the volcanic action. Amphibole, sometimes pure and forming intermediate strata, at other times mixed with granite, as in the basanites or basalts of the ancients, may, of itself, furnish all the iron contained in the black and stony lavas. This quantity amounts in the basalt of the modern mineralogists only to $0 \cdot 20$, while in amphibole it exceeds 0.30 .

From several well-informed persons, to whom I addressed myself, I learned that there are calcareous formations in the Great Canary, Forteventura, and Lancerota.* I was not able to determine the nature of this secondary rock ; but it appears certain, that the island of Teneriffe is altogether destitute of it; and that in its alluvial lands it exhibits only clayey calcareous tufa, alternating with volcanic breccia, said to contain, (near the village of La Rambla, at Calderas, and near Candelaria,) plants, imprints of fishes,

- At Lancerota calcareous stone is burned to lime with a fire made of the alhulaga, a new species of thorny and arborescent Sonchus.
buccinites, and other fossil marine productions. M. Cordier brought away some of this tufa, which resembles that in the environs of Naples and Rome, and contains fragments of reeds. At the Salvages, which islands La Perouse took at a distance for masses of scorim, even fibrous gypsum is found.

I had seen, while herborizing between the port of Orotava and the garden of La Paz, heaps of grayish calcareous stones, of an imperfect conchoidal fracture, and analogous to that of Mount Jura and the Apennines. I was informed that these stones were extracted from a quarry near Rambla; and that there were similar quarries near Realejo, and the mountain of Roxas, above Adexa. This information led meinto an error. As the coasts of Portugal consist of basalts covering calcareous rocks containing shells, I imagined that a trappean formation, like that of the Vicentin in Lombardy, and of Harutsh in Africa, might have extended from the banks of the Tagus and Cape St. Vincent as far as the Canary Islands; and that the basalts of the Peak might perhaps conceal a secondary calcareous stone. These conjectures exposed me to severe animadversions from M. G. A. de Luc, who is of opinion that every volcanic island is only an accumulation of lavas and scoriæ. M. de Luc declares it is impossible that real lava should contain fragments of vegetable substances. Our collections, however, contain pieces of trunks of palm-trees, enclosed and penetrated by the very liquid lava of the isle of Bourbon.

Though Teneriffe belongs to a group of islands of considerable extent, the Peak exhibits nevertheless all the characteristics of a mountain rising on a solitary islet. The lead finds no bottom at a little distance from the ports of Santa Cruz, Orotava, and Garachico: in this respect it is like St. Helena. The ocean, as well as the continents, has its mountains and its plains; and, if we except the Andes, volcanic cones are formed everywhere in the lower regions of the globe.

As the Peak rises amid a system of basalts and old lava, and as the whole part which is visible above the surface of the waters exhibits burnt substances, it has been supposed that this immense pyramid is the effect of a progressive accumulation of lavas; or that it contains in its centre a nucleus of primitive rocks. Both of these suppositions
appear to me ill-founded. I think there is as little probability that mountains of granite, gneiss, or primitive calcareous stone have existed where we now see the tops of the Peak, of Vesuvius, and of Etna, as in the plains where almost in our own time has been formed the volcano of Jorullo, which is more than a third of the height of Vesuvius. On examining the circumstances which accompanied the formation of the new island, called Sabrina, in the archipelago of the Azores;* on carefully reading the minute and simple narrative, given by the Jesuit Bourguignon of the slow appearance of the islet of the little Kameni, near Santorino; we find that these extraordinary eruptions are generally preceded by a swelling of the softened crust of the globe. Rocks appear above the waters before the flames force their way, or lava issue from the crater: we must distinguish between the nucleus raised up, and the mass of lavas and scorim, which successively increases its dimensions.

It is true that from all existing records of revolutions of this kind, the perpendicular height of the stony nucleus appears never to have exceeded one hundred and fifty or two hundred toises; even taking into the account the depth of the sea, the bottom of which had been lifted up: but when considering the great effects of nature, and the intensity of its forces, the bulk of the masses must not deter the geologist in his speculations. Every thing indicates that the physical changes of which tradition has preserved the remembrance, exhibit but a feeble image of those gigantic catastrophes which have given mountains their present form, changed the positions of the rocky strata,

* At Sabrina island, near St. Michael's, the crater opened at the foot of a solid rock, of almost a cubical form. This rock, surmounted by a small elevated plain perfectly level, is more than two hundred toises in breadth. Its formation was anterior to that of the crater, into which, a few days after its opening, the sea made an irruption. At Kameni, the smoke was not even visible till twenty-six days after the appearance of the upheaved rocks. Phil. Trans. vol. xxvi, p. 69 and 200, vol. xxvii., p. 353. All these phenomena, on which Mr. Hawkins collected very valuable observations during his abode at Santorino, are unfavourable to the idea commonly entertained of the origin of volcanic mountains. They are usually ascribed to a progressive accumulation of liquified matter, and the diffusion of lavas issuing from a central mouth.
and buried sea-shells on the summits of the higher Alps. Doubtless, in those remote times which preceded the existence of the human race, the raised crust of the globe produced those domes of trappean porphyry, those hills of isolated basalt on vast elevated plains, those solid nuclei which are clothed in the modern lavas of the Peak, of Etna, and of Cotopaxi. The volcanic revolutions have succeeded each other after long intervals, and at very different periods: of this we see the vestiges in the transition mountains, in the secondary strata, and in those of alluvium. Volcanoes of earlier date than the sandstone and calcareous rocks have been for ages extinguished; those which are yet in activity are in general surrounded only with breccias and modern tufas; but nothing hinders us from admitting, that the archipelago of the Canaries may exhibit some real rocks of secondary formation, if we recollect that subterranean fires have been there rekindled in the midst of a system of basalts and very ancient lavas.

We seek in vain in the Periplus of Hanno or of Scylax for the first written notions on the eruptions of the Peak of Teneriffe. Those navigators sailed timidly along the coast, anchoring every evening in some bay, and had no knowledge of a volcano distant fifty-six leagues from the coast of Africa. Hanno nevertheless relates, that he saw torrents of light, which seemed to fall on the sea; that every night the coast was covered with fire; and that the great mountain, called the Car of the Gods, appeared to throw up sheets of flame, which rose even to the clouds. But this mountain, situated northward of the island of the Gorilli, formed the western extremity of the Atlas chain; and it is `also very uncertain whether the flames seen by Hanno were the effect of some volcanic eruption, or whether they must be attributed to the custom, common to many nations, of setting fire to the forests and dry grass of the savannahs. In our own days similar doubts were entertained by the naturalists, who, in the voyage of d'Entrecasteaux, saw the island of Amsterdam covered with a thick smoke. On the coast of the Caracas, trains of reddish fire, fed by the burning grass, appeared to me, for several nights, under the delusive semblance of a current of lava, descending from the mountains, and dividing itself into several branches.

Though the narratives of Hanno and Scylax, in the state m which they have reached us, contain no passage which we can reasonably apply to the Canary Islands, it is very probable that the Carthaginians, and even the Phonicians, had some knowledge of the Peak of Teneriffe. In the time of Plato and Aristotle, vague notions of it had reached the Greeks, who considered the whole of the coast of Africa, beyond the Pillars of Hercules, as thrown into disorder by the fire of volcanoes. The Abode of the Blessed, which was sought first in the north, beyond the Riphæan mountains, among the Hyperboreans, and next to the south of Cyrenaica, was supposed to be situated in regions that were considered to be westward, being the direction in which the world known to the ancients terminated. The name of Fortonate Islands was long in as vague signification, as that of El Dorado among the conquerors of America. Happiness was thought to reside at the end of the earth, as we seek for the most exquisite enjoyments of the mind in an ideal world beyond the limits of reality.

We must not be surprised that, previous to the time of Aristotle, we find no accurate notion respecting the Canary Islands and the volcanoes they contain, among the Greek geographers. The only nation whose navigations extended toward the west and the north, the Carthaginians, were interested in throwing a veil of mystery over those distant regions. While the senate of Carthage was averse to any partial emigration, it pointed out those islands as a place of refage in times of trouble and public misfortune; they were to the Carthaginians what the free soil of America has become to Europeans amidst their religious and civil dissensions.

The Canaries were not better known to the Romans till eighty-four years before the reign of Augustus. A private individual was desirous of executing the project, which wise foresight had dictated to the senate of Carthage. Sertorius, conquered by Sylla, and weary of the din of war, looked out for a safe and peaceable retreat. He chose the Fortunate Islands, of which a delightful picture had been

* The idea of the happiness, the great civilization, and the riches of the inhabitants of the north, was common to the Greeks, to the people of India, and to the Mexicans.
drawn for him on the shores of Bxtica. He carefully combined the notions he acquired from travellers; but in the little that has been transmitted to us of those notions, and in the more minute descriptions of Sebosus and Juba, there is no mention of volcanoes or volcanic eruptions. Scarcely can we recognise the isle of Teneriffe, and the snows with which the summit of the Peak is covered in winter, in the name of Nivaria, given to one of the Fortunate Islands. Hence we might conclude, that the volcano at that time threw out no flames, if it were allowable so to interpret the silence of a few authors, whom we know only by short fragments or dry nomenclatures. The naturalist vainly seeks in history for documents of the first eruptions of the Peak; he nowhere finds any but in the language of the Guanches, in which the word Echeyde denotes, at the same time, hell and the volcano of Teneriffe.

Of all the written testimonies, the oldest I have found in relation to the activity of this volcano dates from the beginning of the sixteenth century. It is contained in the narrative of the voyage of Aloysio Cadamusto, who landed at the Canaries in 1505. This traveller was witness of no eruptions, but he positively affirms that, like Etna, this mountain burns without interruption, and that the fire has been seen by christians held in slavery by the Guanches of Teneriffe. The Peak, therefore, was not at that time in the state of repose in which we find it at present; for it is certain that no navigator or inhabitant of Teneriffe has seen issue from the mouth of the Peak, I will not say flames, but even any smoke visible at a distance. It would be well, perhaps, were the funnel of the Caldera to open anew; the lateral eruptions would thereby be rendered less violent, and the whole group of islands would be less endangered by earthquakes.

The eruptions of the Peak have been very rare for two centuries past, and these long intervals appear to characterize volcanoes highly elevated. The smallest one of all, Stromboli, is almost always burning. At Vesuvius, the eruptions are rarer than formerly, though still more frequent than those of Etna and the Peak of Teneriffe. The colossal summits of the Andes, Cotopaxi and Tungurahua, scarcely have an eruption once in a century. We may say, that
in active volcanoes the frequency of the eruptions is in the inverse ratio of the height and the mass. The Peak also had seemed extinguished during ninety-two years, when, in 1798, it made its last eruption by a lateral opening formed in the mountain of Chahorra. In this interval Vesuvius had sixteen eruptions.

The whole of the mountainous part of the kingdom of Quito may be considered as an immense volcano, occupying more than seven hundred square leagues of surface, and throwing out flames by different cones, known under the particular denominations of Cotopaxi, Tungurahua, and Pichincha. The group of the Canary Islands is situated on the same sort of submarine volcano. The fire makes its way sometimes by one and sometimes by another of these islands. Teneriffe alone contains in its centre an immense pyramid terminating in a crater, and throwing out, from one century to another, lava by its flanks. In the other islands, the different eruptions have taken place in various parts; and we nowhere find those isolated mountains to which the volcanic effects are confined. The basaltic crust, formed by ancient volcanoes, seems everywhere undermined; and the currents of lava, seen at Lancerota and Palma, remind us, by every geological affinity, of the eruption which took place in 1301 at the island of Ischia, amid the tufas of Epomeo.

The exclusively lateral action of the peak of Teneriffe is a geological phenomenon, the more remarkable as it contributes to make the mountains which are backed by the principal volcano appear isolated. It is true, that in Etna and Vesuvius the great flowings of lava do not proceed from the crater itself, and that the abundance of melted matter is generally in the inverse ratio of the height of the opening whence the lava is ejected. But at Vesuvius and Etna a lateral eruption constantly terminates by flashes of flame and by ashes issuing from the crater, that is, from the summit of the mountain. At the Peak this phenomenon has not been witnessed for ages : and yet recently, in the eruption of 1798, the crater remained quite inactive. Its bottom did not sink in; while at Vesuvius, as M. von Buch has observed, the greater or less depth of the vol. I.
crater is an infallible indication of the proximity of a new eruption.

I might terminate these geological sketches by enquiring into the nature of the combustible which has fed for so many thousands of years the fire of the peak of Teneriffe;-I might examine whether it be sodium or potassium, the metallic basis of some earth, carburet of hydrogen, or pure sulphur combined with iron, that burns in the volcano ;-but wishing to limit myself to what may be the object of direct observation, I shall not take upon me to solve a problem for which we have not yet sufficient data. We know not whether we may conclude, from the enormous quantity of sulphur contained in the crater of the Peak, that it is this substance which keeps up the heat of the volcano; or whether the fire, fed by some combustible of an unknown nature, effects merely the sublimation of the sulphur. What we learn from observation is, that in craters which are still burning, sulphur is very rare; while all the ancient volcanoes end in becoming sulphur-pits. We might presume that, in the former, the sulphur is combined with oxygen, while, in the latter, it is merely sublimated; for nothing hitherto authorises us to admit that it is formed in the interior of volcanoes, like ammonia and the neutral salts. When we were yet unacquainted with sulphur, except as disseminated in the muriatiferous gypsum and in the Alpine limestone, we were almost forced to the belief, that in every part of the globe the volcanic fire acted on rocks of secondary formation; but recent observations have proved that sulphur exists in great abundance in those primitive rocks which so many phenomena indicate as the centre of the volcanic action. Near Alausi, at the back of the Andes of Quito, I found an immense quantity in a bed of quartz, which formed a layer of mica-slate. This fact is the more important, as it is in strict conformity with the conclusions deduced from the observation of those fragments of ancient rocks which are thrown out intact by volcanoes.

We have just considered the island of Teneriffe merely in a geological point of view; we have seen the Peak towering amid fractured strata of basalt and mandelstein; let us examine how these fused masses have been gradually
adorned with vegetable clothing, what is the distribution of plants on the steep declivity of the volcano, and what is the aspect or physiognomy of vegetation in the Canary Islands.
In the northern part of the temperate zone, the cryptogamous plants are the first that cover the stony crust of the globe. The lichens and mosses, that develope their foliage beneath the snows, are succeeded by gramina and other phanerogamous plants. This order of vegetation differs on the borders of the torrid zone, and in the countries between the tropics. We there find, it is true, whatever some travellers may have asserted, not only on the mountains, but also in humid and shady places, almost on a level with the sea, Funaria, Dicranum, and Bryum; and these genera, among their numerous species, exhibit several which are common to Lapland, to the Peak of Teneriffe, and to the Blue Mountains of Jamaica.* Nevertheless, in general, it is not by mosses and lichens that vegetation in the countries near the tropics begins. In the Canary Islands, as well as in Guinea, and on the rocky coasts of Peru, the first vegetation which prepares the soil are the succulent plants; the leaves of which, provided with an infinite number of orifices $\dagger$ and cutaneous vessels, deprive the ambient air of the water it holds in solution. Fixed in the crevices of volcanic rocks, they form, as it were, that first layer of vegetable earth with which the currents of lithoid lava are clothed. Wherever these lavas are scorified, and where they have a shining surface, as in the basaltic mounds to the north of Lancerota, the development of vegetation is extremely slow, and many ages may pass away before shrubs can take root. It is only when lavas are covered with tufa and ashes, that the volcanic islands, losing that appearance of nudity which marks their origin, bedeck themselves in rich and brilliant vegetation.

[^30]In its present state, the island of Teneriffe, the Chinerfe* of the Guanches, exhibits five zones of plants, which we may distinguish by the names-region of vines, region of laurels, region of pines, region of the retama, and region of grasses. These zones are ranged in stages, one above another, and occupy, on the steep declivity of the Peak, a perpendicular height of 1750 toises; while fifteen degrees farther north, on the Pyrenees, snow descends to thirteen or fourteen hundred toises of absolute elevation. If the plants of Teneriffe do not reach the summit of the volcano, it is not because the perpetual snow and the cold of the surrounding atmosphere mark limits which they cannot pass; it is the scorified lava of the Malpays, the powdered and barren pumice-stone of the Piton, which impede the mıgration of plants towards the brink of the crater.

The first zone, that of the vines, extends from the sea-shore to two or three hundred toises of height; it is that which is most inhabited, and the only part carefully cultivated. In the low regions, at the port of Orotava, and wherever the winds have free access, the centigrade thermometer stands in winter, in the months of January and February, at noon, between fifteen and seventeen degrees; and the greatest heats of summer do not exceed twenty-five or twenty-six degrees. The mean temperature of the coasts of Teneriffe appears at least to rise to twenty-one degrees ( $16.8^{\circ}$ Reaumur) ; and the climate in those parts keeps at the medium between the climate of Naples and that of the torrid zone.

The region of the vines exhibits, among its vegetable productions, eight kinds of arborescent Euphorbia; Mesembrianthema, which are multiplied from the Cape of Good Hope to the Peloponnesus; the Cacalia Kleinia, the Dracæna, and other plants, which in their naked and tortuous trunks, in their succulent leaves, and their tint of blueish green, exhibit distinctive marks of the vegetation of Africa. It is in this zone that the date-tree, the plantain, the sugar-cane, the Indian fig, the Arum Colocasia, the root of which furnishes a nutritive fecula, the olive-tree, the fruit trees of Europe, the vine, and corn are cultivated. Corn is reaped from the end of March to the beginning of

* Of Chinerfe the Europeans have formed, by corruption, Tchineriffe and Teneriffe.

May; and the culture of the bread-fruit tree of Otaheite, that of the cinnamon tree of the Moluccas, the coffee-tree of Arabia, and the cacao-tree of America, have been tried with success. On several points of the coast the country assumes the character of a tropical landscape; and we perceive that the region of the palms extends beyond the limits of the torrid zone. The chamærops and the date-tree flourish in the fertile plains of Murviedro, on the coasts of Genoa, and in Provence, near Antibes, between the thirtyninth and forty-fourth degrees of latitude; a few trees of the latter species, planted within the walls of the city of Rome, resist even the cold of $2.5^{\circ}$ below freezing point. But if the south of Europe as yet only partially shares the gifts lavished by nature on the zone of palms, the island of Teneriffe, situated on the parallel of Egypt, southern Persia, and Florida, is adorned with the greater part of the vegetable forms which add to the majesty of the landscape in the regions near the equator.
On reviewing the different tribes of indigenous plants, we regret not finding trees with small pinnated leaves, and arborescent gramina. No species of the numerous family of the sensitive-plants has migrated as far as the archipelago of the Canary Islands, while on both continents they have been seen in the thirty-eighth and fortieth degrees of latitude. On a more careful examination of the plants of the islands of Lancerota and Forteventura, which are nearest the coast of Morocco, we may perhaps find a few mimosas among many other plants of the African Hora.
The second zone, that of the laurels, comprises the woody part of Teneriffe: this is the region of the springs, which gush forth amidst turf always verdant, and never parched with drought. Lofty forests crown the hills leading to the volcano, and in them are found four species of laurel,* an oak nearly resembling the Quercus Turneri $\dagger$ of the mountains of Thibet, the Visnea mocanera, the Myrica Faya of the Azores, a native olive (Olea excelsa), which is the largest tree of this zone, two species of Sideroxylon, the leaves of which are

[^31]extremely beautiful, the Arbutus callicarpa, and other evergreen trees of the family of myrtles. Bindweeds, and an ivy very different from that of Europe (Hedera canariensis) entwine the trunks of the laurels; at their feet vegetate a numberless quantity of ferns,* of which three species $\dagger$ alone descend as low as the region of the vines. The soil, covered with mosses and tender grass, is enriched with the flowers of the Campanula aurea, the Chrysanthemum pinnatifidum, the Mentha canariensis, and several bushy species of Hypericum. $\ddagger$ Plantations of wild and grafted chesnut-trees form a broad border round the region of the springs, which is the greenest and most agreeable of the whole.

In the third zone (beginning at nine hundred toises of absolute height), the last groups of Arbutus, of Myrica Faya, and of that beautiful heath known to the natives by the name of Texo, appear. This zone, four hundred toises in breadth, is entirely filled by a vast forest of pines, among which mingles the Juniperus cedro of Broussonnet. The leaves of these pines are very long and stiff, and they sprout sometimes by pairs, but oftener by threes in one sheath. Having had no opportunity of examining the fructification, we cannot say whether this species, which has the appearance of the Scotch fir, is really different from the eighteen species of pines with which we are already acquainted in Europe. M. Decandolle is of opinion that the pine of Teneriffe is equally distinct from the Pinus atlantica of the neighbouring mountains of Mogador, and from the pine of Aleppo, § which belongs to the basin of the Mediterranean, and does not appear to have passed the Pillars of Hercules. We met with these last pines on the slope of the Peak, near twelve hundred toises above the level of the

[^32]sea. In the Cordilleras of New Spain, under the torrid zone, the Mexican pines extend to the height of two thousand toises. Notwithstanding the similarity of structure existing between the different species of the same genus of plants, each of them requires a certain degree of temperature and rarity in the ambient air to attain its due growth. If in temperate climates, and wherever snow falls, the uniform heat of the soil be somewhat above the mean heat of the atmosphere, it is probable that at the height of Portillo the roots of the pines draw their nourishment from a soil, in which, at a certain depth, the thermometer rises at most to nine or ten degrees.
The fourth and fifth zones, the regions of the retama and the gramina, occupy heights equal to the most inaccessible summits of the Pyrenees. It is the sterile part of the island where heaps of pumice-stone, obsidian, and broken lava, form impediments to vegetation. We have already spoken of those flowery tufts of alpine broom (Spartium nubigenum), which form oases amidst a vast desert of ashes. Two herbaceous plants, the Scrophularia glabrata and the Viola cheiranthifolia, advance even to the Malpays. Above a turf scorched by the heat of an African sun, an arid soil is overspread by the Cladonia paschalis. Towards the summit of the Peak the Urceolarea and other plants of the family of the lichens, help to work the decomposition of the scorified matter. By this unceasing action of organic force the empire of Flora is extended over islands ravaged by voloanoes.

On surveying the different zones of the vegetation of Teneriffe, we perceive that the whole island may be considered as a forest of laurels, arbutus, and pines, containing in its centre a naked and rocky soil, unfit either for pasturage or cultivation. M. Broussonnet observes, that the archipelago of the Canaries may be divided into two groups of islands; the first comprising Lancerota and Forteventura, the second Teneriffe, Canary, Gomera, Ferro, and Palma. The appearance of the vegetation essentially differs in these two groups. The eastern islands, Lancerota and Forteventura, consist of extensive plains and mountains of little elevation; they have very few springs, and bear the appearance, still more than the other islands, of having been separated from the continent. The winds blow in the same direction, and at the same periods: the Euphorbia mauri-
tanica, the Atropa frutescens, and the arborescent Sonchus, vegetate there in the loose sands, and afford, as in Africa, food for camels. The western group of the Canaries presents a more elevated soil, is more woody, and is watered by a greater number of springs.
Though the whole archipelago contains several plants found also in Portugal,* in Spain, at the Azores, and in the north-west of Africa, yet a great number of species, and even some genera, are peculiar to Teneriffe, to Porto Santo, and to Madeira. Such are the Mocanera, the Plocama, the Bosea, the Canarina, the Drusa, and the Pittosporum. A form which may be called northern, that of the cruciform plant, $\dagger$ is much rarer in the Canaries than in Spain and in Greece. Still farther to the south, in the equinoctial regions of both continents, where the mean temperature of the air rises above twenty-two degrees, the cruciform plants are scarcely ever to be seen.

A question highly interesting to the history of the progressive marks of organization on the globe has been very warmly discussed in our own times, that of ascertaining whether the polymorphous plants are more common in the volcanic islands. The vegetation of Teneriffe is unfavourable to the hypothesis that nature in new countries is but little subject to permanent forms. M. Broussonnet, who resided so long at the Canaries, asserts that the variable plants are not more common there than in the south of Europe. May

* M. Willdenow and myself found, among the plants of the peak of Teneriffe, the beautiful Satyrium diphyllum (Orchis cordata, Willd.), which Mr. Link discovered in Portugal. The Canaries have, in common with the Flora of the Azores, not the Dicksonia culcita, the only arborescent heath found at the thirty-ninth degree of latitude, but the Asplenium palmatum, and the Myrica Faya. This last tree is met with in Portugal, in a wild state. Count Hoffmansegg has seen very old trunks of it; but it was doubtful whether it was indigenous, or imported into that part of our continent. In reflecting on the migrations of plants, and on the geological possibility, that lands sunk in the ocean may have heretofore united Portugal, the Azores, the Canaries, and the chain of Atlos, we conceive, that the existence of the Myrica Faya in western Europe is a phenomenon at least as striking as that of the pine of Aleppo would be at the Azores.
$\dagger$ Among the small number of cruciform species contained in the Flora of Teneriffe, we shall here mention Cheiranthus longifolius, l'Hérit. ; Ch. fructescens, Vent.; Ch. scoparius, Brouss.; Erysimum bicorne, Aiton; Crambe strigosa, and C. lævigata, Brouss.
it not to be presumed, that the polymorphous species, which are so abundant in the isle of Bourbon, are assignable to the nature of the soil and climate rather than to the newness of the vegetation?

Before we take leave of the old world to pass into the new, I must advert to a subject which is of general interest, because it belongs to the history of man, and to those fatal revolutions which have swept off whole tribes from the face of the earth. We inquire at the isle of Cuba, at St. Domingo, and in Jamaica, where is the abode of the primitive inhabitants of those countries? We ask at Teneriffe what is become of the Guanches, whose mummies alone, buried in caverns, have escaped destruction? In the fifteenth century almost all mercantile nations, especially the Spaniards and the Portuguese, sought for slaves at the Canary Islands, as in later times they have been sought on the coast of Guinea.* The Christian religion, which in its origin was so highly favourable to the liberty of mankind, served afterwards as a pretext to the cupidity of Europeans. Every individual, made prisoner before he received the rite of baptism, became a slave. At that period no attempt had yet been made to prove that the blacks were an intermediate race between man and animals. The swarthy Guanche and the African negro were simultaneously sold in the market of Seville, without a question whether slavery should be the doom only of men with black skins and woolly hair.

The archipelago of the Canaries was divided into several small states hostile to each other, and in many instances the same island was subject to two independent princes. The trading nations, influenced by the hideous policy still exercised on the coast of Africa, kept up intestine warfare. One Guanche then became the property of another, who sold him to the Europeans; several, who preferred death to slavery, killed themselves and their children. The population of the Canaries had considerably suffered by the slave trade, by the depredations of pirates, and especially by a long period of carnage, when Alonzo de Lugo completed the conquest of the Guanches. The surviving remnants of the

[^33]race perished mostly in 1494, in the terrible pestilence called the modorra, which was attributed to the quantity of dead bodies left exposed in the open air by the Spaniards after the battle of La Laguna. The nation of the Guanches was extinct at the beginning of the seventeenth century; a few old men only were found at Candelaria and Guimar.

It is, however, consoling to find that the whites have not always disdained to intermarry with the natives; but the Canarians of the present day, whom the Spaniards familiarly call Isleños (Islanders), have very powerful motives for denying this mixture. In a long series of generations time effaces the characteristic marks of a race; and ás the descendants of the Andalusians settled at Teneriffe are themselves of dark complexion, we may conceive that intermarriages cannot have produced a perceptible change in the colour of the whites. It is very certain that no native of pure race exists in the whole island. It is true that a few Canarian families boast of their relationship to the last shep-herd-king of Guimar, but these pretensions do not rest on very solid foundations, and are only renewed from time to time when some Canarian of more dusky hue than his countrymen is prompted to solicit a commission in the service of the king of Spain.

A short time after the discovery of America, when Spain was at the highest pinnacle of her glory, the gentle character of the Guanches was the fashionable topic, as we in our times laud the Arcadian innocence of the inhabitants of Otaheite. In both these pictures the colouring is more vivid than true. When nations, wearied with mental enjoyments, behold nothing in the refinement of manners but the germ of depravity, they are pleased with the idea, that in some distant region, in the first dawn of civilization, infant society enjoys pure and perpetual felicity. To this sentiment Tacitus owed a part of his success, when he sketched for the Romans, subjects of the Cæsars, a picture of the manners of the inhabitants of Germany. The same sentiment gives an ineffable charm to the narrative of those travellers who, at the close of the last century, visited the South Sea Islands.

The inhabitants of those islands, too much vaunted (and previously anthropophagi), resemble, under more than one point of view, the Guanches of Teneriffe. Both nations
were under the yoke of feudal government. Among the Guanches, this institution, which facilitates and renders a state of warfare perpetual, was sanctioned by religion. The priests declared to the people: "The great Spirit, Achaman, created first the nobles, the achimenceys, to whom he distributed all the goats that exist on the face of the earth. After the nobles, Achaman created the plebeians, achicaxnas. This younger race had the boldness to petition also for goats; but the supreme Spirit answered, that this race was destined to serve the nobles, and that they had need of no property." This tradition was made, no doubt, to please the rich vassals of the shepherd-kings. The faycan, or high priest, also exercised the right of conferring nobility; and the law of the Guanches expressed that every achimencey who degraded himself by milking a goat with his own hands, lost his claim to nobility. This law does not remind us of the simplicity of the Homeric age. We are astonished to see the useful labours of agriculture, and of pastoral life, exposed to contempt at the very dawn of civilization.
The Guanches, famed for their tall stature, were the Patagonians of the old world. Historians exaggerated the muscular strength of the Guanches, as, previous to the voyage of Bougainville and Cordoba, colossal proportions were attributed to the tribe that inhabited the southern extremity of America. I never saw Guanche mummies but in the cabinets of Europe. At the time I visited the Canaries they were very scarce; a considerable number, however, might be found if miners were employed to open the sepulchral caverns which are cut in the rock on the eastern slope of the Peak, between Arico and Guimar. These mummies are in a state of desiccation so singular, that whole bodies, with their integuments, frequently do not weigh above six or seven pounds; or a third less than the skeleton of an individual of the same size, recently stripped of the muscular flesh. The conformation of the skull has some slight resemblance to that of the white race of the ancient Egyptians; and the incisive teeth of the Guanches are blunted, like those of the mummies found on the banks of the Nile. But this form of the teeth is the result of art; and on examining more carefully the physiognomy of the ancient Canarians, Blumenbach and other able anatomists have recognized in the cheek bones and the lower jaw perceptible differences from the Egyptian
mummies. On opening those of the Guanches, remains of aromatic plants are discovered, among which the Chenopodium ambrosioïdes is constantly perceived: the bodies are often decorated with small laces, to which are hung little discs of baked earth, which appear to have served as numerical signs, and resemble the quippoes of the Peruvians, the Mexicans, and the Chinese.

The population of islands being in general less exposed than that of continents to the effect of migrations, we may presume that, in the time of the Carthaginians and the Greeks, the archipelago of the Canaries was inhabited by the same race of men as were found by the Norman and Spanish conquerors. The only monument that can throw any light on the origin of the Guanches is their language; but unhappily there are not above a hundred and fifty words extant, and several express the same object, according to the dialect of the different islanders. Independently of these words, which have been carefully noted, there are still some valuable fragments existing in the names of a great number of hamlets, hills, and valleys. The Guanches, like the Biscayans, the Hindoos, the Peruvians, and all primitive nations, named places after the quality of the soil, the shape of the rocks, the caverns that gave them shelter, and the nature of the tree that overshadowed the springs.*

[^34]The greater attention we direct to the study of languages in a philosophical point of view, the more we must observe that no one of them is entirely distinct. The language of the Guanches would appear still less so, had we any data respecting its mechanism and grammatical construction; two elements more important than the form of words, and the identity of sounds. It is the same with certain idioms, as with those organized beings that seem to shrink from all classification in the series of natural families. Their isolated state is merely apparent; for it ceases when, on embracing a greater number of objects, we come to discover the intermediate links. Those learned enquirers who trace Egyptians wherever there are mummies, hieroglyphics, or pyramids, will imagine perhaps that the race of Typhon was united to the Guanches by the Berbers, real Atlantes, to whom belong the Tibboes and the Tuarycks of the desert: but this hypothesis is supported by no analogy between the Berberic and Coptic languages, which are justly considered as remnants of the ancient Egyptian.

The people who have succeeded the Guanches are descended from the Spaniards, and in a more remote degree from the Normans. Though these two races have been exposed during three centuries past to the same climate, the latter is distinguished by the fairer complexion. The descendants of the Normans inhabit the valley of Teganana, between Punta de Naga and Punta de Hidalgo. The names of Grandville and Dampierre are still pretty common in this district. The Canarians are a moral, sober, and religious people, of a less industrious character at home than in foreign countries. A roving and enterprising disposition leads these islanders, like the Biscayans and Catalonians, to the Philippines, to the Ladrone Islands, to America, and wherever there are Spanish settlements, from Chile and La Plata to New Mexico. To them we are in a great measure indebted for the progress of agriculture in those colonies. The whole archipelago does not contain 160,030 inhabitants, and the Isleños are perhaps more numerous in the new continent than in their own country.

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## Chapter III. <br> Passage from Teneriffe to South America.-The Island of Tobago.Arrival at Cumana.

We left the road of Santa Cruz on the 25th of June, and directed our course towards South America. We soon lost sight of the Canary Islands, the lofty mountains of which were covered with a reddish vapour. The Peak alone appeared from time to time, as at intervals the wind dispersed the clouds that enveloped the Piton. We felt, for the first time, how strong are the impressions left on the mind from the aspect of those countries situated on the limits of the torrid zone, where nature appears at once so rich, so various, and so majestic. Our stay at Teneriffe had been very short, and yet.we withdrew from the island as if it had long been our home.

Our passage from Santa Cruz to Cumana, the most eastern part of the New Continent, was very fine. We cut the tropic of Cancer on the 27 th ; and though the Pizarro was not a very fast sailer, we made, in twenty days, the nine hundred leagues, which separate the coast of Africa from that of the New Continent. We passed fifty leagues west of Cape Bojador, Cape Blanco, and the Cape Verd islands. A few land birds. which had been driven to sea by the impetuosity of the wind followed us for several days.

The latitude diminished rapidly, from the parallel of Madeira to the tropic. When we reached the zone where the trade-winds are constant, we crossed the ocean from east to west, on a calm sea, which the Spanish sailors call the Ladies' Gulf, el Golfo de las Damas. In proportion as we advanced towards the west, we found the trade-winds fix to eastward.

These winds, the most generally adopted theory of which is explained in a celebrated treatise of Halley,* are a phe-

* The existence of an upper current of air, which blows constantly
from the equator to the poles, and of a lower current, which blows from
the poles to the equator, had already been admitted, as M. Arago has
shown, by Hooke. The ideas of the celebrated English naturalist are
developed in a Discourse on Earthquakes, published in 1686 . 'I think
nomenon much more complicated than most persons admit. In the Atlantic Ocean, the longitude, as well as the declination of the sun, influences the direction and limits of the trade-winds. In the direction of the New Continent, in both hemispheres, these limits extend beyond the tropics eight or nine degrees; while in the vicinity of Africa, the variable winds prevail far beyond the parallel of 28 or 27 degrees. It is to be regretted, on account of the progress of meteorology and navigation, that the changes of the currents of the equinoctial atmosphere in the Pacific are much less known than the variation of these same currents in a sea that is narrower, and influenced by the proximity of the coasts of Guinea and Brazil. The difference with which the strata of air flow back from the two poles towards the equator cannot be the same in every degree of longitude, that is to say, on points of the globe where the continents are of very different breadths, and where they stretch away more or less towards the poles.

It is known, that in the passage from Santa Cruz to Cumana, as in that from Acapulco to the Philippine Islands, seamen are scarcely ever under the necessity of working their sails. We pass those latitudes as if we were descending a river, and we might deem it no hazardous undertaking if we made the voyage in an open boat. Farther west, on the coast of St. Martha and in the Gulf of Mexico, the trade-wind blows impetuously, and renders the sea very stormy.*
The wind fell gradually the farther we receded from the African coast: it was sometimes smooth water for several hours, and these short calms were regularly interrupted by electrical phenomena. Black thick clouds, marked by strong outlines, rose on the east, and it seemed as if a squall would have forced us to hand our topsails; but the breeze fresh-
(adds he) that several phenomena, which are presented by the atmosphere and the ocean, especially the winds, may be explained by the polar currents."-Hooke's Posthumous Works, p. 364.
*The Spanish sailors call the rough trade-winds at Carthagena in the West Indias los brisotes de Santa Martha; and in the Gulf of Mexico, las brizas pardas. These latter winds are accompanied with a gray and cloudy sky.
ened anew, there fell a few large drops of rain, and the storm dispersed without our hearing any thunder. Meanwhile it was curious to observe the effect of several black, isolated, and very low clouds, which passed the zenith. We felt the force of the wind augment or diminish progressively, according as small bodies of vesicular vapour approached or receded, while the electrometers, furnished with a long metallic rod and lighted match, showed no change of electric tension in the lower strata of the air. It is by help of these squalls, which alternate with dead calms, that the passage from the Canary Islands to the Antilles, or southern coast of America, is made in the months of June and July.

Some Spanish navigators have lately proposed going to the West Indies and the coasts of Terra-Firma by a course different from that which was taken by Columbus. They advise, instead of steering directly to the south in search of the trade-winds, to change both latitude and longitude, in a diagonal line from Cape St. Vincent to America. This method, which shortens the way, cutting the tropic nearly twenty degrees west of the point where it is commonly cut by pilots, was several times successfully adopted by Admiral Gravina. That able commander, who fell at the battle of Trafalgar, arrived in 1802 at St. Domingo, by the oblique passage, several days before the French fleet, though orders of the court of Madrid would have forced him to enter Ferrol with his squadron, and stop there some time.

This new system of navigation shortens the passage from Cadiz to Cumana one-twentieth; but as the tropic is attained only at the longitude of forty degrees, the chance of meeting with contrary winds, which blow sometimes from the south, and at other times from the south-west, is more unfavourable. In the old system, the disadvantage of making a longer passage is compensated by the certainty of catching the trade-winds in a shorter space of time, and keeping them the greater part of the passage. At the time of my abode in the Spanish colonies, 1 witnessed the arrival of several merchant-ships, which from the fear of privateers had chosen the oblique course, and had had a very short passage.

Nothing can equal the beauty and mildness of the climate
of the equinoctial region on the ocean. While the trade wind blew strongly, the thermometer kept at 23 or 24 degrees in the day, and at 22 or 22.5 degrees during the night. The charm of the lovely climates bordering on the equator, can be fully enjoyed only by those who have undertaken the voyage from Acapulco or the coasts of Chile to Europe in a very rough season. What a contrast between the tempestuous seas of the northern latitudes and the regions where the tranquillity of nature is never disturbed! If the return from Mexico or South America to the coasts of Spain were as expeditious and as agreeable as the passage from the old to the new continent, the number of Europeans settled in the colonies would be much less considerable than it is at present. To the sea which surrounds the Azores and the Bermuda Islands, and which is traversed in returning to Europe by the high latitudes, the Spaniards have given the singular name of Golfo de las Yeguas (the Mares' Gulf). Colonists who are not accustomed to the sea, and who have led solitary lives in the forests of Guiana, the savannahs of the Caracas, or the Cordilleras of Peru, dread the vicinity of the Bermudas more than the inhabitants of Lima fear at present the passage round Cape Horn.

To the north of the Cape Verd Islands we met with great masses of floating seaweeds. They were the tropic grape, (Fucus natans), which grows on submarine rocks, only from the equator to the fortieth degree of north and south latitude. These weeds seem to indicate the existence of currents in this place, as well as to south-west of the banks of Newfoundland. We must not confound the latitudes abounding in scattered weeds with those banks of marine plants, which Columbus compares to extensive meadows, the sight of which dismayed the crew of the Santa Maria in the forty-second degree of longitude. I am convinced, from the comparison of a great number of journals, that in the basin of the Northern Atlantic there exist two banks of weeds very different from each other. The most extensive is a little west of the meridian of Fayal, one of the Azores, between the twenty-fifth and thirty-sixth degrees of latitude.* The temperature of the Atlantic in those

* It would appear that Phoenician vessels came "in thirty days' sail, with an easterly wind," to the weedy sea, which the Portuguese and VOL. 1.
latitudes is from sixteen to twenty degrees, and the north winds, which sometimes rage there very tempestuously, drive floating isles of seaweed into the low latitudes as far as the parallels of twenty-four and even twenty degrees. Vessels returning to Europe, either from Monte Video or the Cape of Good Hope, cross these banks of Fucus, which the Spanish pilots consider as at an equal distance from the Antilles and Canaries; and they serve the less instructed mariner to rectify his longitude. The second bank of Fucus is but little known; it occupies a much smaller space, in the twenty-second and twenty-sixth degrees of latitude, eighty leagues west of the meridian of the Bahama Islands. It is found on the passage from the Caiques to the Bermudas.

Though a species of seaweed* has been seen with stems eight hundred feet long, the growth of these marine cryptogamia being extremely rapid, it is nevertheless certain, that in the latitudes we have just described, the Fuci, far from being fixed to the bottom, float in separate masses on the surface of the water. In this state, the vegetation can scarcely last longer than it would in the branch of a tree torn from its trunk; and in order to explain how moving masses are found for ages in the same position, we must admit that they owe their origin to submarine rocks, which, lying at forty or sixty fathoms' depth, continually supply what has been carried away by the equinoctial currents. This current bears the tropic grape into the high latitudes, toward the coasts of Norway and France; and it is not the Gulf-stream, as some mariners think, which accumulates the Fucus to the south of the Azores.

The causes that unroot these weeds at depths where it is generally thought the sea is but slightly agitated, are not sufficiently known. We learn only, from the observations
Spaniards call mar de zargasso. I have shown, in another place ("Views of Nature," Bohn's edition, p. 46), that the passage of Aristotle, De Mirabil. (ed. Duval, p. 1157), can scarcely be applied to the coasts of Africa, like an analogous passage of the Periplus of Scylax. Supposing that this sea, full of weeds, which impeded the course of the Phœenician vessels, was the mar de sargasso, we need not admit that the ancients navigated the Atlantic beyond thirty degrees of west longitude from the meridian of Paris.

* The baudreux of the Falkland Islande; Fucus giganteus, Foretar ; Laminaria pyrifera Lemour.
of M. Lamouroux, that if the fucus adhere to the rocks with the greatest firmness before its fructification, it separates with great facility after that period, or during the season which suspends its vegetation like that of the terrestriad plants. The fish and mollusca which gnaw the stems of the seaweeds no doubt contribute also to detach them from their roots.

From the twenty-second degree of latitude, we found the surface of the sea covered with flying-ish,* which threw themselves up into the air, twelve, fifteen, or eighteen feet, and fell down on the deck. I do not hesitate to speak on a subject of which voyagers discourse as frequently as of dolphins, sharks, sea-sickness, and the phosphorescence of the ocean. None of these topics can fail to afford interesting observations to naturalists, provided they make them their particular study. Nature is an inexhaustible source of investigation, and in proportion as the domain of science is extended, she presents herself to those who know how to interrogate her, under forms which they have never yet examined.

I have named the flying-fish, in order to direct the attention of naturalists to the enormous size of their natatory bladder, which, in an animal of $6 \cdot 4$ inches, is $3: 6$ inches long, 0.9 of an inch broad, and contains three cubic inches and a half of air. As this bladder occupies more than half the size of the fish, it is probable that it contributes to its lightness. We may assert that this reservoir of air is more fitted for flying than swimming; for the experiments made by $\mathbf{M}$. Provenzal and myself have proved, that, even in the species which are provided with this organ, it is not indispensably necessary for the ascending movement to the surface of the water. In a young flying-fish, $5 \cdot 8$ inches long, each of the pectoral fins, which serve as wings, presented a surface to the air of $3 \frac{7}{18}$ square inches. We observed, that the nine branches of nerves, which go to the twelve rays of these fins, are almost three times the size of the nerves that belong to the ventral fins. When the former of these nerves are excited by galvanic electricity, the rays which support the membrane of the pectoral fin extend with five times the force with which the other fins move when

- Exocoetus volitans.
galvanised by the same metals. Thus, the fish is capable of throwing itself horizontally the distance of twenty feet before retouching the water with the extremity of its fins. This motion has been aptly compared to that of a flat stone, which, thrown horizontally, bounds one or two feet above the water. Notwithstanding the extreme rapidity of this motion, it is certain, that the animal beats the air during the leap; that is, it alternately extends and closes its pectoral fins. The same motion has been observed in the flying scorpion of the rivers of Japan: they also contain a large air-bladder, with which the great part of the scorpions that have not the faculty of flying are unprovided. The flyingfish, like almost all animals which have gills, enjoy the power of equal respiration for a long time, both in water and in air, by the same organs; that is, by extracting the oxygen from the atmosphere as well as from the water in which it is dissolved. They pass a great part of their life in the air; but if they escape from the sea to avoid the voracity of the Dorado, they meet in the air the Frigatebird, the Albatross, and others, which seize them in their flight. Thus, on the banks of the Orinoco, herds of the Cabiai, which rush from the water to escape the crocodile, become the prey of the jaguar, which awaits their arrival.

I doubt, however, whether the flying-fish spring out of the water merely to escape the pursuit of their enemies. Like swallows, they move by thousands in a right line, and in a direction constantly opposite to that of the waves. In our own climates, on the brink of a river, illumined by the rays of the sun, we often see solitary fish fearlessly bound above the surface as if they felt pleasure in breathing the air. Why should not these gambols be more frequent with the flyingfish, which from the strength of their pectoral fins, and the smallness of their specific gravity, can so easily support themselves in the air? I invite naturalists to examine whether other flying-fish, for instance the Exocætus exiliens, the Trigla volitans, and the T. hirundo, have as capacious an air-bladder as the flying-fish of the tropics. This last follows the heated waters of the Gulf-stream when they flow northward. The cabin-boys amuse themselves with cutting off a part of the pectoral fins, and assert, that these wings grow
again; which seems to me not unlikely, from facts observed in other families of fishes.
At the time I left Paris, experiments made at Jamaica by Dr. Brodbelt, on the air contained in the natatory bladder of the sword-fish, had led some naturalists to think, that within the tropics, in sea-fish, that organ must be filled with pure orygen gas. Full of this idea, I was surprised at finding in the air-bladder of the flying-fish only 0.04 of oxygen to 0.94 of azote and 0.02 of carbonic acid. The proportion of this last gas, measured by the absorption of lime-water in graduated tubes, appeared more uniform than that of the oxygen, of which some individuals yielded almost double the quantity. From the curious phenomena observed by MM. Biot, Configliachi, and Delaroche, we might suppose, that the swordfish dissected by Dr. Brodbelt had inhabited the lower strata of the ocean, where some fish have as much as 0.92 of oxygen in the air-bladder.

On the 3rd and 4th of July, we crossed that part of the Atlantic where the charts indicate the bank of the Maalstroom ; and towards night we altered our course to avoid the danger, the existence of which is, however, as doubtful as that of the isles Fonseco and St. Anne. It would have been perhaps as prudent to have continued our course. The old charts are filled with rocks, some of which really exist, though most of them are merely the offspring of those optical illusions which are more frequent at sea than in inland places. As we approached the supposed Maal-stroom, we observed no other motion in the waters than the effect of a current which bore to the north-west, and which hindered us from diminishing our latitude as much as we wished. The force of this current augments as we approach the new continent; it is modified by the configuration of the coasts of Brazil and Guiana, and not by the waters of the Orinoco and the Amazon, as some have supposed.
From the time we entered the torrid zone, we were never weary of admiring, at night, the beauty of the southern sky, ' which, as we advanced to the south, opened new constellations to our view. We feel an indescribable sensation when, on approaching the equator, and particularly on passing from * Trigla cucullus.
one hemisphere to the other, we see those stars, which we have contemplated from our infancy, progressively sink, and finally disappear. Nothing awakens in the traveller a livelier remembrance of the immense distance by which he is separated from his country, than the aspect of an unknown firmament. The grouping of the stars of the first magnitude, some scattered nebulæ, rivalling in splendour the milky way, and tracts of space remarkable for their extreme blackness, give a peculiar physiognomy to the southern sky. This sight fills with admiration even those who, uninstructed in the several branches of physical science, feel the same emotion of delight in the contemplation of the heavenly vault, as in the view of a beautiful landscape, or a majestic site. A traveller needs not to be a botanist, to recognize the torrid zone by the mere aspect of its vegetation. Without having acquired any notions of astronomy, without any acquaintance with the celestial charts of Flamstead and De la Caille, he feels he is 'not in Europe, when he sees the immense constellation of the Ship, or the phosphorescent Clouds of Magellan, arise on the horizon. The heavens and the earth,-everything in the equinoctial regions, presents an exotic character.
The lower regions of the air were loaded with vapours for some days. We saw distinctly for the first time the Southern Cross only on the night of the 4th of July, in the sixteenth degree of latitude. It was strongly inclined, and appeared from time to time between the clouds, the centre of which, furrowed by uncondensed lightnings, reflected a silvery light. If a traveller may be permitted to speak of his personal emotions, I shall add, that on that night I experienced the realization of one of the dreams of my early youth.

When we begin to fix our eyes on geographical maps, and to read the narratives of navigators, we feel for certain countries and climates a sort of predilection, which we know not how to account for at a more advanced period of life. These impressions, however, exercise a considerable influence over our determinations; and from a sort of instinct we endeavour to connect ourselves with objects on which the mind has long been fixed as by a secret chamm. At a period when 1 studied the heavens, not with the intention of devoting myself to astronomy, but only to acquire a knowledge of
the stars, I was disturbed by a feeling unknown to those who are devoted to sedentary life. It was painful to me to renounce the hope of beholding the beautiful constellations near the south pole. Impatient to rove in the equinoctial regions, I could not raise my eyes to the starry firmament without thinking of the Southern Cross, and recalling the sublime passage of Dante, which the most celebrated commentators have applied to that constellation:-

> Io mi volsi a man' destra e posi mente All' altro polo, e vidi, quattro stelle Non viste mai fuorch' alla prima gente.
> Goder parea lo ciel di lor fiammelle ; O settentrional vedovo sito Poichè privato sei di mirar quelle!

The pleasure we felt on discovering the Southern Cross was warmly shared by those of the crew who had visited the colonies. In the solitude of the seas we hail a star as a friend, from whom we have long been separated. The Portuguese and the Spaniards are peculiarly susceptible of this feeling; a religious sentiment attaches them to a constellation, the form of which recalls the sign of the faith planted by their ancestors in the deserts of the New World.

The two great stars which mark the summit and the foot of the Cross having nearly the same right ascension, it follows that the constellation is almost perpendicular at the moment when it passes the meridian. This circumstance is known to the people of every nation situated beyond the tropics, or in the southern hemisphere. It has been observed at what hour of the night, in different seasons, the Cross is erect or inclined. It is a timepiece which advances very regularly nearly four minutes a-day, and no other group of stars affords to the naked eye an observation of time so easily made. How often have we heard our guides exclaim in the savannahs of Venezuela, or in the desert extending from Lima to Truxillo, "Midnight is past, the Cross begins to bend!" How often those words reminded us of that affecting scene, where Paul and Virginia, seated near the source of the river of Lataniers, conversed together for the last time, and where the old man, at the sight of the Southern Cross, warns them that it is time to separate.

The last days of our passage were not so felicitous as the mildness of the climate and the calmness of the ocean had led us to hope. The dangers of the sea did not disturb us, but the germs of a malignant fever became manifest on board our vessel as we drew near the Antilles. Between decks the ship was excessively hot, and very much crowded. From the time we passed the tropic, the thermometer was at thirtyfour or thirty-six degrees. Two sailors, several passengers, and, what is remarkable enough, two negroes from the coast of Guinea, and a mulatto child, were attacked with a disorder which appeared to be epidemic. The symptoms were not equally alarming in all the cases; nevertheless, several persons, and especially the most robust, fell into delirium after the second day. No fumigation was made. A Gallician surgeon, ignorant and phlegmatic, ordered bleedings, because he attributed the fever to what he called heat and corruption of the blood. There was not an ounce of bark on board; for we had omitted to take any with us, under the impression that this salutary production of Peru could not fail to be found on board a Spanish vessel.

On the 8th of July, a sailor, who was near expiring, recovered his health from a circumstance worthy of being mentioned. His hammock was so hung, that there was not ten inches between his face and the deck. It was impossible to administer the sacrament in this situation; for, agreeably to the custom on board Spanish vessels, the viaticum must be carried by the light of tapers, and followed by the whole crew. The patient was removed into an airy place near the hatchway, where a small square berth had been formed with sailcloth. Here he was to remain till he died, which was an event expected every moment; but passing from an atmosphere heated, stagnant, and filled with miasma, into fresher and purer air, which was renewed every instant, he gradually revived from his lethargic state. His recovery dated from the day when he quitted the middle deck; and as it often happens in medicine that the same facts are cited in support of systems diametrically opposite, this recovery confirmed our doctor in his idea of the inflammation of the blood, and the necessity of bleeding, evacuating, and all the asthenic remedies. We soon felt the fatal effects of this treatment.

For several days the pilot's reckoning differed $1^{\circ} 12^{\prime}$ in
longitude from that of my time. This difference was owing less to the general current, which I have called the current of rotation, than to that particular movement, which, drawing the waters toward the north-west, from the coast of Brazil to the Antilles, shortens the passage from Cayenne to Guadaloupe.* On the 12th of July, I thought I might foretell our seeing land next day before sunrise. We were then, according to my observations, in latitude $10^{\circ} 46^{\prime}$, and west longitude $60^{\circ} 54^{\prime}$. A few series of lunar distances confirmed the chronometrical result; but we were surer of the position of the vessel, than of that of the land to which we were directing our course, and which was so differently marked in the French, Spanish, and English charts. The longitudes deduced from the accurate observations of Messrs. Churruca, Fidalgo, and Noguera, were not then published.
The pilots trusted more to the log than the timekeeper; they smiled at the prediction of so speedily making land, and thought themselves two or three days' sail from the coast. It was therefore with great pleasure, that on the 13th, about six in the morning, I learned that very high land was seen from the mast-head, though not clearly, as it was surrounded with a thick fog. The wind blew hard, and the sea was very rough. Large drops of rain fell at intervals, and every indication menaced tempestuous weather. The captain of the Pizarro intended to pass through the channel which separates the islands of Tobago and Trinidad; and knowing that our sloop was very slow in tacking, he was afraid of falling to leeward towards the south, and approaching the Boca del Drago. We were in fact surer of our longitude than of our latitude, having had no observation at noon since the 11th. Double altitudes which I took in the morning, after Douwes's method, placed us in $11^{\circ} 6^{\prime} 50^{\prime \prime}$, consequently $15^{\prime}$ north of our reckoning. Though the result clearly proved that the high land on the horizon was not Trinidad, but Tobago, yet

[^36]the captain continued to steer NNW, in search of this latter island.

An observation of the meridian altitude of the sun fully confirmed the latitude obtained by Douwes's method. No more doubt remained as to the position of the vessel, with respect to the island, and we resolved to double Cape North (Tobago) to pass between that island and Grenada, and steer towards a port in Margareta.

The island of Tobago presents a very picturesque aepect. It is merely a heap of rocks carefully cultivated. The dazzling whiteness of the stone forms an agreeable contrast to the verdure of some scattered tufts of trees. Cylindric and very lofty cactuses crown the top of the mountains, and give a peculiar physiognomy to this tropical landscape. The sight of the trees alone is sufficient to remind the navigator that he has reached an American coast; for these cactuses are as exclusively peculiar to the New World, as the heaths are to the Old.

We crossed the shoal which joins Tobago to the island of Grenada. The colour of the sea presented no visible change; but the centigrade thermometer, plunged into the water to the depth of some inches, rose only to $23^{\circ}$; while farther at sea eastward on the same parallel, and equally near the surface, it kept at $25 \cdot 6^{\circ}$. Notwithstanding the currents, the cooling of the water indicated the existence of the shoal, which is noted in only a very few charts. The wind slackened after sunset, and the clouds disappeared as the moon reached the zenith. The number of falling stars was very considerable on this and the following nights; they appeared less frequent towards the north than the south over Terra Firma, which we began to coast. This position seems to prove the influence of local causes on meteors, the nature of which is not yet sufficiently known to us.

On the 14th at sunrise, we were in sight of the Boca del Drago. We distinguished Chacachacarreo, the most westerly of the islands situated between Cape Paria and the north-west cape of Trinidad. When we were five leagues distant from the coast, we felt, near Punta de la Boca, the effect of a particular current which carried the ship south-
ward. The motion of the waters which flow through tho Boca del Drago, and the action of the tides, occasion an eddy. We cast the lead, and found from thirty-six to fortythree fathoms on a bottom of very fine green clay. According to the rules established by Dampier, we ought not to have expected so little depth near a coast formed by very high and perpendicular mountains. We continued to heave the lead till we reached Cabo de tres Puntas* and we every where found shallow water, apparently indicating the prolongation of the ancient coast. In these latitudes the temperature of the sea was from twenty-three to twenty-four degrees, consequently from 1.5 to two degrees lower than in the open ocean, beyond the edge of the bank.

The Cabo de tres Puntas is, according to my observations, in $65^{\circ} 4^{\prime} 5^{\prime \prime}$ longitude. It seemed to us the more elevated, as the clouds concealed the view of its indented top. The aspect of the mountains of Paria, their colour, and especially their generally rounded forms, made us suspect that the coast was granitic ; but we afterwards recognized how delusive, even to those who have passed their lives in scaling mountains, are impressions respecting the nature of rocks seen at a distance.

A dead calm, which lasted several hours, permitted us to determine with exactness the intensity of the magnetic forces opposite the Cabo de tres Puntas. This intensity was greater than in the open sea, to the east of the island of Tobago, in the ratio of from 237 to 229. During the calm the current drew us on rapidly to the west. Its velocity was three miles an hour, and it increased as we approached the meridian of Testigos, a heap of rocks which rises up amidst the waters. At the setting of the moon, the sky was covered with clouds, the wind freshened anew, and the rain descended in one of those torrents peculiar to the torrid zone.

The malady which had broken out on board the Pizarro had made rapid progress, from the time when we approached the coasts of Terra Firma ; but having then almost reached the end of our voyage we flattered ourselves that all who were sick would be restored to health, as soon as we could

* Jape Three Points, the name given to it by Columbus.
land them at the island of St. Margareta, or the port of Cumana, places remarkable for their great salubrity.

This hope was unfortunately not realised. The youngest of the passengers attacked with the malignant fever fell a victim to the disease. He was an Asturian, nineteen years of age, the only son of a poor widow. Several circumstances rendered the death of this young man affecting. His countenance bore the expression of sensibility and great mildness of disposition. He had embarked against his own inclination; and his mother, whom he had hoped to assist by the produce of his efforts, had made a sacrifice of her affection in the hope of securing the fortune of her son, by sending him to the colonies to a rich relation, who resided at the island of Cuba. The unfortunate young man expired on the third day of his illness, having fallen from the beginning into a lethargic state interrupted only by fits of delirium. The yellow fever, or black vomit, at Vera Cruz, scarcely carries off the sick with so alarming a rapidity. Another Asturian, still younger, did not leave for one moment the hed of his dying friend; and, what is very remarkable, did not contract the disorder.

We were assembled on the deck, absorbed in melancholy reflections. It was no longer doubtful, that the fever which raged on board had assumed within the last few days a fatal aspect. Our eyes were fixed on a billy and desert coast on which the moon, from time to time, shed her light athwart the clouds. The sea, gently agitated, emitted a feeble phosphoric light. Nothing was heard but the monotonous cry of a few large sea-birds, flying towards the shore. A profound calm reigned over these solitary regions, but this calm of nature was in discordance with the painful feelings by which we were oppressed. About eight o'clock the dead man's knell was slowly tolled. At this lugubrious sound, the sailors suspended their labours, and threw themselves on their knees to offer a momentary prayer: an affecting ceremony, which brought to our remembrance those times when the primitive christians all considered themselves as members of the same family. All were united in one common sorrow for a misfortune which was felt to be common to all. The corpse of the
young Asturian was brought upon deck during the night, but the priest entreated that it might not be committed to the waves till after sunrise, that the last rites might be performed, according to the usage of the Romish church. There was not an individual on board, who did not deplore the death of this young man, whom we had beheld, but a few days before, full of cheerfulness and health.
Those among the passengers who had not yet felt symptoms of the disease, resolved to leave the vessel at the first place where she might touch, and await the arrival of another packet, to pursue their course to the island of Cuba and to Mexico. They considered the betweendecks of the ship as infected; and though it was by no means clear to me that the fever was contagious, I thought it most prudent to land at Cumana. I wished not to visit New Spain, till I had made some sojourn on the coasts of Venezuela and Paria; a few of the productions of which had been examined by the unfortunate Loefling. We were anxious to behold in their native site, the beautiful plants which Bose and Bredemeyer had collected during their journey to the continent, and which adorn the conservatories of Schoenbrunn and Vienna. It would have been painful to have touched at Cumana, or at Guayra, without visiting the interior of a country so little frequented by naturalists.

The resolution we formed during the night of the 14th of July, had a happy influence on the direction of our travels; for instead of a few weeks, we remained a whole year in this part of the continent. Had not the fever broken out on board the Pizarro, we should never have reached the Orinoco, the Cassiquiare, or even the limits of the Portuguese possessions on the Rio Negro. To this direction given to our travels we were perhaps also indebted for the good health we enjoyed during so long an abode in the equinoctial regions.

It is well known, that Europeans, during the first months after their arrival under the scorching sky of the tropics, are exposed to the greatest dangers. They consider themselves to be safe, when they have passed the rainy season in the West India islands, at Vera Cruz, or at Carthagena. This
opinion is very general, although there are examples of persons, who, having escaped a first attack of the yellow fever, have fallen victims to the same disease in one of the following years. The facility of becoming acclimated, seems to be in the inverse ratio of the difference that exists between the mean temperature of the torrid zone, and that of the native country of the traveller, or colonist, who changes his climate; because the irritability of the organs, and their vital action, are powerfully modified by the influence of the atmospheric heat. A Prussian, a Pole, or a Swede, is more exposed on his arrival at the islands or on the continent, than a Spaniard, an Italian, or even an inhabitant of the South of France. With respect to the people of the north, the difference of the mean temperature, is from nineteen to twentyone degrees, while to the people of southern countries it is only from nine to ten. We were fortunate enough to pass safely through the interval during which a European recently landed runs the greatest danger, in the extremely hot, but very dry climate of Cumana, a city celebrated for its salubrity.

On the morning of the 15 th, when nearly on a line with the hill of St. Joseph, we were surrounded by a great quantity of floating seaweed. Its stems had those extraordinary appendages in the form of little cups and feathers, which Don Hippolyto Ruiz remarked on his return from the expedition to Chile, and which he described in a separate memoir as the generative organs of the Fucus natans. A fortunate accident allowed us the means of verifying a fact which had been but once observed by naturalists. The bundles of fucus collected by M. Bonpland were completely identical with the specimens given us by the learned authors of the Flora of Peru. On examining both with the microscope, we found that the supposed parts of fructification, the stamina and pistils, belong to a new genus, of the family of the Ceratophytæ.

The coast of Paria stretches to the west, forming a wall of rocks of no great height, with rounded tops and a waving outline. We were long without perceiving the bold coasts of the island of Margareta, where we were to stop for the purpose of ascertaining whether we could touch at Guayra. We had learned, by altitudes of the sun, taken under very favourable circumstances, how incorrect at that period were
the most highly-esteemed marine charts. On the morning of the 15 th , when the time-keeper placed us in $66^{\circ} 1^{\prime} 15^{\prime \prime}$ longitude, we were not yet in the meridian of Margareta island; though according to the reduced chart of the Atlantic ocean, we ought to have passed the very lofty western cape of this island, which is laid down in longitude $66^{\circ} 0^{\prime}$. The inaccuracy with which the coasts were delineated previously to the labours of Fidalgo, Noguera, and Tiscar, and I may venture to add, before the astronomical observations I made at Cumana, might have become dangerous to navigators, were not the sea uniformly calm in those regions. The errors in latitude were still greater than those in longitude, for the coasts of New Andalusia stretch to the westward of Cape Three Points (or tres Puntas) fifteen or twenty miles more to the north, than appears in the charts published before the year 1800.

About eleven in the morning we perceived a very low islet, covered with a few sandy downs, and on which we discovered with our glasses no trace of habitation or culture. Cylindrical cactuses rose here and there in the form of candelabra. The soil, almost destitute of vegetation, seemed to have a waving motion, in consequence of the extraordinary refraction which the rays of the sun undergo in traversing the strata of air in contact with plains strongly heated. Under every zone, deserts and sandy shores appear like an agitated sea, from the effect of mirage.

The coasts, seen at a distance, are like clouds, in which each observer meets the form of the objects that occupy his imagination. Our bearings and our chronometer being at variance with the charts which we had to consult, we were lost in vain conjectures. Some took mounds of sand for Indian huts, and pointed out the place where they alleged the fort of Pampatar was situated; others saw herds of goats, which are so common in the dry valley of St. John; or descried the lofty mountains of Macanao, which seemed to them partly hidden by the clouds. The captain resolved to send a pilot on shore, and the men were preparing to get out the long-boat when we perceived two canoes sailing along the coast. We fired a gun as a signal for them, and though we had hoisted Spanish colours, they drew near with distrust. These canoes, like all those in use among the natives, were constructed of the single trunk of a tree. In
each canoe there were eighteen Guayqueria Indians, naked to the waist, and of very tall stature. They had the appearance of great muscular strength, and the colour of their skin was something between brown and copper-colour. Seen at a distance, standing motionless, and projected on the horizon, they might have been taken for statues of bronze. We were the more struck with their appearance, as it did not correspond with the accounts given by some travellers respecting the characteristic features and extreme feebleness of the natives. We afterwards learned, without passing the limits of the province of Cumana, the great contrast existing between the physiognomy of the Guayquerias and that of the Chaymas and the Caribs.

When we were near enough to hail them in Spanish, the Indians threw aside their mistrust, and came straight on board. They informed us that the low islet near which we were at anchor was Coche, which had never been inhabited; and that Spanish vessels coming from Europe were accustomed to sail farther north, between this island and that of Margareta, to take a coasting pilot at the port of Pampatar. Our inexperience had led us into the channel to the south of Coche; and as at that period the English cruisers frequented this passage, the Indians had at first taken us for an enemy's ship. The southern passage is, in fact, highly advantageous for vessels going to Cumana and Barcelona. The water is less deep than in the northern passage, which is much narrower; but there is no risk of touching the ground, if vessels keep very close to the island of Lobos and the Moros del Tunal. The channel between Coche and Margareta is narrowed by the shoals off the north-west cape of Coche, and by the bank that surrounds La Punta de los Mangles.

The Guayquerias belong to that tribe of civilized Indians who inhabit the coasts of Margareta and the suburbs of the city of Cumana. Next to the Caribs of Spanish Guiana they are the finest race of men in Terra Firma. They enjoy several privileges, because from the earliest times of the conquest they remained faithful friends to the Castilians. The king of Spain styles them in his public acts, "his dear, noble, and loyal Guayquerias." The Indians of the two canoes we had met had left the port of Cumana during the night. They were going in search of timber to the forests of cedar (Cedrela odorata, Linn.), which extend from Cape

San Jose to beyond the mouth of Rio Carupano. They gave us some fresh cocoa-nuts, and very beautifully coloured fish of the Chætodon genus. What riches to our eyes were contained in the canoes of these poor Indians! Broad spreading leaves of Vijao* covered bunches of plaintains. The scaly cuirass of an armadillo (Dasypus), the fruit of the calabash tree (Crescentia cujete), used as a cup by the natives, productions common in the cabinets of Europe, had a peculiar charm for us, because they reminded us that, having reached the torrid zone, we had attained the end to which our wishes had been so long directed.

The master of one of the canoes offered to remain on board the Pizarro as coasting pilot (practico). He was a Guayqueria of an excellent disposition, sagacious in his observations, and he had been led by intelligent curiosity to notice the productions of the sea as well as the plants of the country. By a fortunate chance, the first Indian we met on our arrival was the man whose acquaintance became the most useful to us in the course of our researches. I feel a pleasure in recording in this itinerary the name of Carlos del Pino, who, during the space of sixteen months, attended us in our course along the coasts, and into the inland country.

The captain of the corvette weighed anchor towards evening. Before we left the shoal or placer of Coche, I ascertained the longitude of the east cape of the island, which I found to be $66^{\circ} 11^{\prime} 53^{\prime \prime}$. As we steered westward, we soon came in sight of the little island of Cubagua, now entirely deserted, but formerly celebrated for its fishery of pearls. There the Spaniards, immediately after the voyages of Columbus and Ojeda, founded, under the name of New Cadiz, a town, of which there now remains no vestige. At the beginning of the sixteenth century the pearls of Cubagua were known at Seville, at Toledo, and at the great fairs of Augsburg and Bruges. New Cadiz having no water, that of the Rio Manzanares was conveyed thither from the neighbouring coast, though for some reason, I know not what, it was thought to be the cause of diseases of the eyes. The writers of that period all speak, of the riches of the first planters, and the luxury they displayed. At present, downs

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of shifting sand cover this uninhabited land, and the name of Cubagua is scarcely found in our charts.

Having reached these latitudes, we saw the high mountains of Cape Macanao, on the western side of the island of Margareta, which rose majestically on the horizon. If we might judge from the angles of altitude of the tops, taken at eighteen miles' distance, they appeared to be about 500 or 600 toises high. According to Berthoud's time-keeper, the longitude of Cape Macanao is $66^{\circ} 47^{\prime} 5^{\prime \prime}$. I speak of the rocks at the extremity of the cape, and not that strip of . very low land which stretches to the west, and loses itself in a shoal. The position of Macanao and that which I have assigned to the east point of the island of Coche, differ only four seconds in time, from the results obtained by M: Fidalgo.

There being little wind, the captain preferred standing off and on till daybreak. We passed a part of the night on deck. The Guayqueria pilot conversed with us respecting the animals and plants of his country. We learned with great satisfaction that there was a few leagues from the coast a mountainous region inhabited by the Spaniards, in which the cold was sensibly felt; and that in the plains there were two species of crocodiles, very different from each other, besides, boas, electric eels, and several kinds of tigers. Though the words bava, cachicamo, and temblador, were entirely unknown to us, we easily guessed, from the pilot's simple description of their manners and forms, the species which the creoles distinguished by these denominations.

## Chapter IV.

## First abode at Cumana_-Banks of the Manzanares.

On the 16th of July, 1799, at break of day, we beheld a verdant coast, of picturesque aspect. The mountains of New Andalusia, half-veiled by mists, bounded the horizon to the south. The city of Cumana and its castle appeared between groups of cocosntrees. We anchored in the port about nine in the morning, forty-one days after our departure from Corunna; the sick dragged themselves on deck to

- enjoy the sight of a land which was to put an end to their . sufferings. Our eyes were fixed on the groups of cocoa-trees which border the river: their trunks, more than sixty feet high, towered over every object in the landscape. The plain was covered with the tufts of Cassia, Caper, and those arborescent mimosas, which, like the pine of Italy, spread their branches in the form of an umbrella. The pinnated leaves of the palms were conspicuous on the azure sky, the clearness of which was unsullied by any trace of vapour. The sun was ascending rapidly toward the zenith. A dazzling light was spread through the air, along the whitish hills strewed with cylindric cactuses, and over a sea ever calm, the shores of which were peopled with alcatras,* egrets, and flamingoes. The splendour of the day, the vivid colouring of the vegetable world, the forms of the plants, the varied plumage of the birds, everything was stamped with the grand character of nature in the equinoctial regions.

The city of Cumana, the capital of New Andalusia, is a mile distant from the embarcadero, or the battery of the Boca, where we landed, after having passed the bar of the Manzanares. We had to cross a vast plain, called el Salado, which divides the suburb of the Guayquerias from the seacoast. The excessive heat of the atmosphere was augmented by the reverberation of the soil, partly destitute of vegetation. The centigrade thermometer, plunged into the white sand, rose to $37.7^{\circ}$. In the small pools of salt water it kept at $30 \cdot 5^{\circ}$, while the heat of the ocean, at its surface,

[^38]I 2
is generally, in the port of Cumana, from $25.2^{\circ}$ to $26.3^{\circ}$. The first plant we gathered on the continent of America was the Avicennia tomentosa, ${ }^{*}$ which in this place scarcely reaches two feet in height. This shrub, together with the sesuvium, the yellow gomphrena, and the cactus, cover soil impregnated with muriate of soda; they belong to that small number of plants which live in society like the heath of Europe, and which in the torrid zone are found only on the seashore, and on the elevated plains of the Andes. $\dagger$ The Avicennia of Cumana is distinguished by another peculiarity not less remarkable: it furnishes an instance of a plant common to the shores of South America and the coasts of Malabar.

The Indian pilot led us across his garden, which rather resembled a copse than a piece of cultivated ground. He showed us, as a proof of the fertility of this climate, a silkcotton tree (Bombax heptaphyllum), the trunk of which, in its fourth year, had reached nearly two feet and a half in diameter. We have observed, on the banks of the Orinoco and the river Magdalena, that the bombax, the carolinea, the ochroma, and other trees of the family of the malvacea, are of extremely rapid growth. I nevertheless think that there was some exaggeration in the report of the Indian respecting the age of his bombax; for under the temperate zone, in the hot and damp lands of North America, between the Mississippi and the Alleghany mountains, the trees do not exceed a foot in diameter, in ten years. Vegetation in those parts is in general but a fifth more speedy than in Europe, even taking as an example the Platanus occidentalis, the tulip tree, and the Cupressus disticha, which reach from nine to fifteen feet in diameter. On the strand of Cumana, in the garden of the Guayqueria pilot, we saw for the first time a quama $\ddagger$ loaded with flowers, and remarkable for the extreme

## * Mangle prieto.

$\dagger$ On the extreme rarity of the social plants in the tropics, see my "Essay on the Geog. of Plants," p. 19; and a paper by Mr. Brown on the Proteacea, "Trans. of the Lin. Soc.," vol. X., p. 1, p. 23, in which that great botanist has extended and confirmed by numerous facts my ideas on the association of plants of the same species.
$\ddagger$ Inya spuria, which we must not confound with the common inga, Inga vera, Willd. (Mimosa Inga, Linn.). The white stamina, which, to the number of sixty or seventy, are attached to a greenish corolla, have a silky lustre,
length and silvery splendour of its numerous stamina. We crossed the suburb of the Guayqueria Indians, the streets of which are very regular, and formed of small houses, quite new, and of a pleasing appearance. This part of the town had just been rebuilt, for the earthquake had laid Cumana in ruins eighteen months before our arrival. By a wooden bridge; we crossed the river Manzanares, which contains a few bavas, or crocodiles of the smaller species.

We were conducted by the captain of the Pizarro to the governor of the province, Don Vincente Emparan, to present to him the passports furnished to us by the first Secretary of State at Madrid. He received us with that frankness and unaffected dignity which have at all times characterized the natives of Biscay. Before he was appointed governor of Portobello and Cumana, Don.Vincente Emparan had distinguished himself as captain of a vessel in the navy. His name recalls to mind one of the most extraordinary and distressing events recorded in the history of maritime warfare. At the time of the last rupture between Spain and England, two brothers of Señor Emperan, both of whom commanded ships in the Spanish navy, engaged with each other before the port of Cadiz, each supposing that he was attacking an enemy. A fierce battle was kept up during a whole night, and both the vessels were sunk almost simultaneously. A very small part of the crew was saved, and the two brothers had the misfortune to recognize each other a little before they expired.

The governor of Cumana expressed his great satisfaction at the resolution we had taken to remain for some time in New Andalusia, a province which at that period was but little known even by name in Europe, and which in its mountains, and on the banks of its numerous rivers, contains a great number of objects worthy of fixing the attention of naturalists. Señor Emperan showed us cottons dyed with native plants, and fine furniture made exclusively of the wood of the country. He was much interested in everything that related to natural philosophy; and asked, to our great astonishment, whether we thought, that, under the
and are terminated by a yellow anther. The flower of the guama is eighteen lines long. The common height of this fine tree, which prefers a moist soil, is from eight to ten toises.
beautiful sky of the tropics, the atmosphere contained less azote (azotico) than in Spain; or whether the rapidity with which iron oxydates in those climates, were only the effect of greater humidity as indicated by the air hygrometer. The name of his native country pronounced on a distant shore would not have been more agreeable to the ear of a traveller, than those words azote, oxide of iron, and hygrometer, were to ours. Señor Emparan was a lover of science, and the public marks of consideration which he gave us during a long abode in his government, contributed greatly to procure us a favourable welcome in every part of South America.

We hired a spacious house, the situation of which was fạvourable for astronomical observations. We enjoyed an agreeable coolness when the breeze arose; the windows were without glass, and even without those paper panes which are often substituted for glass at Cumana. The whole of the passengers of the Pizarro left the vessel, but the recovery of those who had been attacked by the fever was very slow. We saw some who, a month after, notwithstanding the care bestowed on them by their countrymen; were still extremely weak and reduced. Hospitality, in the Spanish colonies, is such, that a European who arrives, without recommendation or pecuniary means, is almost sure of finding assistance, if he land in any port on account of sickness. The Catalonians, the Galieians, and the Biscayans, have the most frequent intercourse with America. They there form as it were three distinct corporations, which exercise a remarkable influence over the morals, the industry, and commerce of the colonies. The poorest inhabitant of Siges or Vigo is sure of being received into the house of a Catalonian or Galician pulpero,* whether he land in Chile or the Philippine Islands.

Among the sick who landed at Cumana was:a negro, who fell into a state of insanity a few days after our arrival; he died in that deplorable condition, though his master, almost seventy years old, who had left Europe to settle at San Blas, at the entrance of the gulf of California, had attended him with the greatest care. I relate this fact as affording evidence that men born under the torrid zone, after having dwelt in temperate climates, sometimes feel the pernicious

[^39]effects of the heat of the tropics. The negro was a young man, eighteen years of age, very robust, and born on the coast of Guinea; an abode of some years on the high plain of Castile, had imparted to his organization that kind of irritability which renders the miasma of the torrid zone so dangerous to the inhabitants of the countries of the north.

The site on which Cumana is built is part of a tract of ground, very remarkable in a geological point of view. The chain of the calcareous Alps of the Brigantine and the Tataraqual stretches east and west from the summit of the Impossible to the port of Mochima and to Campanario. The sea, in times far remote, appears to have divided this chain from the rocky coasts of Araya and Maniquarez. The vast gulf of Cariaco has been caused by an irruption of the sea; and no doubt can be entertained but that the waters once covered, on the southern bank, the whole tract of land impregnated with muriate of soda, through which flows the Manzanares. The slow retreat of the waters has turned into dry ground this extensive plain, in which rises a group of small hills, composed of gypsum and calcareous breccias of very recent formation. The city of Cumana is backed by this group, which was formerly an island of the gulf of Cariaco. That part of the plain which is north of the city, is called Plaga Chica, or the Little Plain, and extends eastwards as far as Punta Delgada, where a narraw valley, cavered with yellow gomphrena, still marks the point of the ancient outlet of the waters.

The hill of calcareous breccias, which we have just mentioned as having once been an island in the ancient gulf, is covered with a thick forest of cylindric cactus and opuntia. Some of these trees, thirty or forty feet high, are covered with lichens, and are divided into several branches in the form of candelabra. Near Maniquarez, at Punta Araya, we measured a cactus,* the trunk of which was four feet nine inches in circumference. A European acquainted only with the opuntia in our hot-houses is surprised to see the wood of this plant become so hard from age, that it resists for centuries both air and moisture: the Indians of Cumana therefore employ it in preference to any other for oars and door-posts.

[^40]Cumana, Coro, the island of Margareta, and Curassoa, are the parts of South America that abound most in plants of the nopal family. There only, a botanist, after a long residence, could compose a monography of the genus cactus, the species of which vary not only in their flowers and fruits, but also in the form of their articulated stems, the number of costæ, and the disposition of the thorns. We shall see hereafter how these plants, which characterize a warm and singularly dry climate, like that of Egypt and California, gradually disappear in proportion as we remove from the coasts, and penetrate into the inland country.

The groups of columnar cactus and opuntia produce the same effect in the arid lands of equinoctial America as the junceæ and the hydrocharides in the marshes of our northern climes. Places in which the larger species of the strong cactus are collected in groups are considered as almost impenetrable. These places are called Tunales; and they are impervious not only to the native, who goes naked to the waist, but are formidable even to those who are fully clothed. In our solitary rambles we sometimes endeavoured to penetrate into the Tunal that crowns the summit of the castle hill, a part of which is crossed by a pathway, where we could have studied, amidst thousands of specimens, the organization of this singular plant. Sometimes night suddenly overtook us, for there is scarcely any twilight in this climate; and we then found ourselves dangerously situated, as the Cascabel, or rattle-snake, the Coral, and other vipers armed with poisonous fangs, frequent these scorched and arid haunts, to deposit their eggs in the sand.

The castle of San Antonio is built at the western extremity of the hill, but not on the most elevated point, being commanded on the east by an unfortified summit. The Tunal is considered both here and everywhere in the Spanish colonies as a very important means of military defence; and when earthen works are raised, the engineers are eager to propagate the thorny opuntia, and promote its growth, as they are careful to keep crocodiles in the ditches of fortified places. In regions where organized nature is so powerful and active, man summons as auxiliaries in his defence the carnivorous reptile, and the plant with its formidable armour of thorns.

The castle is only thirty toises above the level of the water in the gulf of Cariaco. Standing on a naked and calcareous hill, it commands the town, and has a very picturesque effect when viewed from a vessel entering the port. It forms a bright object against the dark curtains of those mountains which raise their summits to the clouds, and of which the vaporous and bluish tint blends with the azure sky. On descending from Fort San Antonio to the south-west, we find on the slope of the same rock the ruins of the old castle of Santa Maria. This site is delightful to those who wish to enjoy at the approach of sunset the freshness of the breeze and the view of the gulf. The lofty summits of the island of Margareta are seen above the rocky coast of the isthmus of Araya, and towards the west the small islands of Caracas, Picuita, and Boracha, recall to mind the catastrophes that have overwhelmed the coasts of Terra Firma. These islets resemble fortifications, and from the effect of the mirage (while the inferior strata of the air, the ocean, and the soil, are unequally heated by the sun), their points appear raised like the extremity of the great promontories of the coast. It is pleasing, during the day, to observe these inconstant phenomena; we see, as night approaches, these stony masses which had been suspended in the air, settle down on their bases; and the luminary, whose presence vivifies organic nature, seems by the variable inflection of its rays to impress motion on the stable rock, and give an undulating movement to plains covered with arid sands.*

The town of Cumana, properly so called, occupies the ground lying between the castle of San Antonio and the small rivers of Manzanares and Santa Catalina. The Delta, formed by the bifurcation of the first of these rivers, is a fertile plain covered with Mammees, Sapotas (achras), plantains, and other plants cultivated in the gardens or charas of the Indians. The town has no remarkable edifice, and the frequency of earthquakes forbids such embellishments. It is true, that strong shocks occur less frequently in a given time at Cumana than at Quito, where we nevertheless find

[^41]sumptuous and very lofty churches. But the earthquakes of Quito are violent only in appearance, and, from the peculiar nature of the motion and of the ground, no edifice there is overthrown. At Cumana, as well as at Lima, and in several cities situated far from the mouths of burning volcanoes, it happens that the series of slight shocks is interrupted after a long course of years by great catastrophes, resembling the effects of the explosion of a mine. We shall have occasion to return to this phenomenon, for the explanation of which so many vain theories have been imagined, and which have been classified according to perpeldicular and horizontal movements, shock, and oscillation.*

The suburbs of Cumana are almost as populous as the ancient town. They are three in number :-Serritos, on the road to the Plaga Chicha, where we meet with some fine tamarind trees; St. Francis, towards the south-east; and the great suburb of the Guayquerias, or Guayguerias. The name of this tribe of Indians was quite unknown before the conquest. The natives who bear that name formerly belonged to the nation of the Guaraounos, of which we find remains only in the swampy lands of the branches of the Orinoco. Old men have assured me that the language of their ancestors was a dialect of the Guaraouno ; but that for a. century past no native of that tribe at Cumana, or in the island of Margareta, has spoken any other language than Castilian.

The denomination Guayqueria, like the words Peru and Peruvian, owes its origin to a mere mistake. The companions of Christopher Columbus, coasting along the island of Margareta, the northern coast of which is still inhabited by the noblest portion of the Guayqueria nation, $\dagger$ encountered

[^42]a few natives who were harpooning fish by throwing a pole tied to a cord, and terminating in an extremely sharp point. They asked them in the Hayti language their name ; and the Indians, thinking that the question of the strangers related to their harpoons, which were formed of the hard and: heary wood of the Macana palm, answered guaike, guaiko, which signifies pointed pole. A striking difference at present exists between the Guayquerias, a civilized tribe of shilful fishermen, and those savage Guaraounos of the Orinoeo, who suspend their habitations on the trunks of the Moriche palm. The population of Cumana has been singularly exaggerated, but according to the most authentic registers it does not exceed 16,000 souls.

Probably the Indian suburb will by degrees extend as far as the Embarcadero; the plain, which is not yet covered with houses or huts, being more than 340 toises in length. The heat is somewhat less oppressive on the side near the sea-shore, than in the old town, where the reverberation of the calcareous soil, and the proximity of the mountain of San Antonio, raise the temperature to an excessive degree. In the suburb of the Guayquerias, the sea breezes have free access; the soil is clayey, and, for that reason, it is thought to be less exposed to violent shoeks of earthquake, than the houses at the foot of the rocks and hills on the right hank of the Manzanares.

The shore near the mouth of the small river Santa Catalina, is bordered with mangrove trees,* but these mangroves are not sufficiently spread to diminish the salubrity of the air of Cumana. The soil of the plain is in part destitute of vegotation, in part covered with tufts of Sesuvium portulacastrum, Gomphrena flava, G.myrtifolia, Talinum cuspidatum, T.cumanense, and Portulaca lanuginosa. Among these herbaceous plants we find at intervals the Avicennia tomentosa, the Scoparia dulcis, a frutescent mimosa with very irritable
(so called on account of the vessel of Columbus having anchored there,) and the port of Manzanillo, where they first swore to the whites in 1498, that friendship which they have never betrayed, and which has obtainod for them, in court phraseology, the title of fieles, loyal.-See p. 144.

* Rhizophora mangle. M. Bonpland found on the Plaga Chica the Allionia incarnata, in the same place where the unfortunate Loefling had. discovered this now genus of Nyctagines.
leaves," and particularly cassias, the number of which is so great in South America, that we collected, in our travels, more than thirty new species.

On leaving the Indian suburb, and ascending the river southward, we found a grove of cactus, a delightful spot, shaded by tamarinds, ${ }^{\text {s }}$ brazilettos, bombax, and other plants, remarkable for their leaves and flowers. The soil here is rich in pasturage, and dairy-houses built with reeds, are separated from each other by clumps of trees. The milk remains fresh, when kept, not in the calabashest of very thick ligneous fibres, but in porous earthen vessels from Maniquarez. A prejudice prevalent in northern countries had long led me to believe, that cows, under the torrid zone, did not yield rich milk ; but my abode at Cumana, and especially an excursion through the vast plains of Calabozo, covered with grasses, and herbaceous sensitive plants, convinced me that the ruminating animals of Europe become perfectly habituated to the hottest climates, provided they find water and good nourishment. Milk is excellent in the provinces of New Andalusia, Barcelona, and Venezuela; and butter is better in the plains of the equinoctial zone, than on the ridge of the Andes, where the Alpine plants, enjoying in no season a sufficiently high temperature, are less aromatic than on the Pyrenees, on the mountains of Estremadura, or of Greece. As the inhabitants of Cumana prefer the coolness of the sea breeze to the sight of vegetation, their favourite walk is the open shore. The Spaniards, who in general have no great predilection for trees, or for the warbling of birds, have transported their tastes and their habits into the colonies. In Terra Firma, Mexico, and Peru, it is rare to see a native plant a tree, merely with the view of procuring shade; and if we except the environs of the great capitals, walks bordered with trees are almost unknown in those countries. The arid plain of Cumana exhibits after violent showers an extraordinary phenomenon. The earth, when drenched with rain, and

[^43]heated again by the rays of the sun, emits that musky odour which in the torrid zone, is common to animals of very different classes, viz.: to the jaguar, the small species of tiger cat, the cabiai or thick-nosed tapir,* the galinazo vulture, $\dagger$ the crocodile, the viper, and the rattlesnake. The gaseous emanations, which are the vehicles of this aroma, seem to be evolved in proportion only as the mould, containing the spoils of an innumerable quantity of reptiles, worms, and insects, begins to be impregnated with water. I have seen Indian children, of the tribe of the Chaymas, draw out from the earth and eat millepedes or scolopendras $\ddagger$ eighteen inches long, and seven lines broad. Whenever the soil is turned up, we are struck with the mass of organic substances, which by turns are developed, transformed, and decomposed. Nature in these climates appears more active, more fruitful, we may even say more prodigal, of life.

On this shore, and near the dairies just mentioned, we enjoy, especially at sunrise, a very beautiful prospect over an elevated group of calcareous mountains. As this group subtends an angle of three degrees only at the house where we dwelt, it long served me to compare the variations of the terrestrial refraction with the meteorological phenomena. Storms are formed in the centre of this Cordillera; and we see from afar thick clouds resolve into abundant rains, while during seven or eight months not a drop of water falls at Cumana. The Brigantine, which is the highest part of this chain, raises itself in a very picturesque manner behind Brito and Tataraqual. It takes its name from the form of a very deep valley on the northern declivity, which resembles the interior of a ship. The summit of this mountain is almost bare of vegetation, and is flat like that of Mowna-Roa, in the Sandwich Islands. It is a perpendicular wall, or, to use a more expressive term of the Spanish navigators, a table (mesa). This peculiar form, and the sym-

[^44]metrical arrangement of a few cones which surround the Brigantine, made me at first think that this group, which is wholly calcareous, contained rocks of basaltic or trappean formation.

The governor of Cumana sent, in 1797, a band of determined men to explore this entirely desert country, and to open a direct road to New Barcelona, by the summit of the Mesa. It was reasonably expected that this way would be shorter, and less dangerous to the health of travellers, than the route taken by the couriers along the coasts ; but every -attempt to cross the chain of the mountains of the Brigantine was fruitless. In this part of America, as in Australia* to the west of Sydney, it is not so much the height of the mountain chains, as the form of the recks, that presents obstacles difficult to surmount.

The longitudinal valley formed by the lofty mountains of the interior and the southern declivity of the Cerro de San Antonio, is intersected by the Rio Manzanares. This plain, the only thoroughly wooded part in the environs of Cumana, is called the Plain of the Charas, $\dagger$ on account of the numerous plantations which the inhabitants have begun, for some years past, along the river. A narrow path leads from the hill of San Francisco across the forest to the hospital of the Capuchins, a very agreeable country-house, which the Aragonese monks have built as a retreat for old infirm missionaries, who can no longer fulfil the duties of their ministry. As we advance to the west, the trees of the forest become more vigorous, and we meet with a few monkeys, $\ddagger$ which, however, are very rare in the environs of Cumana. At the foot of the capparis, the bauhinia, and the zygophyllum with flowers of a golden yellow, there extends a carpet of Bromelia,§ akin to the B. karatas, which from the odour and coolness of its foliage attracts the rattlesnake.

[^45]The waters of the Manzanares are very limpid, in quality and this river has no resemblance to the Manzanares of Madrid, which appears the more magnificent in contrast with the fine bridge by which it is crossed. It takes its source, like all the rivers of New Andalusia, in the savannahs (llanos) known by the names of the plateaux of Jonoro, Amana, and Guanipa," and it receives, near the Indian village of San Fernando, the waters of the Rio Juanillo. It has been several times proposed to the government, but without success, to construct a dyke at the first ipure, in order to form artificial irrigations in the plain of Charas; for, notwithstanding its apparent sterility, the soil is extremely productive, wherever humidity is combined with the heat of the climate. The cultivators were gradually to refund the money advanced for the construction of the sluices. Meanwhile, pumps worked by mules, and other hydraulic but imperfect machines, have been erected, to serve till this project is carried into execution.

The banks of the Manzanares are very pleasant, and are shaded by mimosas, erythrinas, ceibas, and other trees of gigantic growth. A river, the temperature of which, in the season of the floods, descends as low as twenty-two degrees, when the air is at thirty and thirty-three degrees, is an inestimable benefit in a country where the heat is excessive during the whole year, and where it is so agreeable to bathe several times in the day. The children pass a considerable part of their lives in the water; all the inhabitants, even the women of the most opulent families, know how to swim; and in a country where man is so near the state of nature, one of .the first questions asked on meeting in the morning is, whether the water is cooler than it was on the preceeding -evening. One of the modes of bathing is curious. We every evening visited a family, in the suburb of the Guayquerias. In a fine moonlight night, chairs were placed in the water; the men and women were lightly clothed, as in some baths of the north of Europe; and the family and strangers, assembled in the river, passed some hours in smoking cigars, and in talking, according to the custom of

- These three eminences bear the names of mesas, tables. An immense phain has an almost imperceptible rise from both sides to the middle, without any appearance of mountains or hills.
the country, of the extreme dryness of the season, of the abundant rains in the neighbouring districts, and particularly of the extravagancies of which the ladies of Cumana accuse those of the Caracas and the Havannah. The company were under no apprehensions from the bavas, or small crocodiles, which are now extremely scarce, and which approach men without attacking them. These animals are three or four feet fong. We never met with them in the Manzanares, but with a great number of dolphins (toninas), which sometimes ascend the river in the night, and frighten the bathers by spouting water.

The port of Cumana is a roadstead capable of receiving the fleets of Europe. The whole of the Gulf of Cariaco, which is about 35 miles long and 48 broad, affords excellent anchorage. The Pacific is not more calm on the shores of Peru, than the Caribbean Sea from Porto-cabello, and especially from Cape Codera to the point of Paria. The hurricanes of the West Indies are never felt in these regions. The only danger in the port of Cumana is a shoal, called Morro Roxo. There are from one to three fathoms water on this shoal, while just beyond its edges there are eighteen, thirty, and even thirty-eight. The remains of an old battery, situated north-north-east of the castle of San Antonio, and very near it, serve as a mark to avoid the bank of Morro Roxo.

The city lies at the foot of a hill destitute of verdure, and is commanded by a castle. No steeple or dome attracts from afar the eye of the traveller, but only a few trunks of tamarind, cocoa, and date trees, which rise above the houses, the roofs of which are flat. The surrounding plains, especially those on the coasts, wear a melancholy, dusty, and arid appearance, while a fresh and luxuriant vegetation marks from afar the windings of the river, which separates the city from the suburbs; the population of European and mixed race from the copper-coloured natives. The hill of fort San Antonio, solitary, white, and bare, reflects a great mass of light, and of radiant heat: it is composed of breccia, the strata of which contain numerous fossils. In the distance, towards the south, stretches a vast and gloomy curtain of mountains. These are the high calcareous Alps of New Andalusia, surmounted by sandstone, and other more
recent formations. Majestic forests cover this Cordillera of the interior, and they are joined by a woody vale to the open clayey lands and salt marshes of the environs of Cumana. A few birds of considerable size contribute to give a peculiar character to these countries. On the seashore, and in the gulf, we find flocks of fishing herons, and alcatras of a very unwieldy form, which swim, like the swan, raising their wings. Nearer the habitation of man, thousands of galinazo vultures, the jackals of the winged tribe, are ever busy in disintermng the carcases of animals.* A gulf, containing hot and submarine springs, divides the secondary from the primary and schistose rocks of the peninsula of Araya. Each of these coasts is washed by a tranquil sea, of azure tint, and always gently agitated by a breeze from one quarter. A bright clear sky, with a few light clouds at sunset, reposes on the oceam, on the treeless peninsula, and on the plains of Cumana, while we see the storms accumulate and descend in fertile showers among the inland mountains. Thus on these coasts, as well as at the foot of the Andes, the earth and the sky present the extremes of clear weather and fogs, of drought and torrents of rain, of absolute nudity and never-ceasing verdure.

The analogies which we have just indicated, between the sea-coasts of New Andalusia and those of Peru, extend also to the recurrence of earthquakes, and the limits which nature seems to have prescribed to these phenomena. We have ourselves felt very violent shocks at Cumana; and we learned on the spot, the most minute circumstances that accompanied the great catastrophe of the 14th December, 1797.

It is a very generally received opinion on the coasts of Cumana, and in the island of Margareta, that the gulf of Cariaco owes its existence to a rent of the continent attended by an irruption of the sea. The remembrance of that great event was preserved among the Indians to the end of the fifteenth century; and it is related that, at the time of the third voyage of Christopher Columbus, the natives mentioned it as of very recent date. In 1530, the inhabitants were alarmed by new shocks on the coasts of Paria and Cumana. The land was inundated by the sea, and the small fort, built by James Castellon at New Toledo, $\dagger$ was entirely destroyed. At

- Buffon, Hist. Nat. des Oiseaux, tom. i., p. 114.
$\dagger$ This was the first name given to the city of Cumana.-Girolamo VOL. $I$.
the same time an enormous opening was formed in the mountains of Cariaco, on the shores of the gulf bearing that name, when a great body of salt-water, mixed with asphaltum, issued from the micaceous schist. Earthquakes were very frequent about the end of the sixteenth century; and, according to the traditions preserved at Cumana, the sea often inundated the shores, rising from fifteen to twenty fathoms.

As no record exists at Cumana, and its archives, owing to. the continual devastations of the termites, or white ants, contain no document that goes back farther than a hundred and fifty years, we are unacquainted with the precise dates of the ancient earthquakes. We only know, that, in times nearer our own, the year 1776 was at once the most fatal to the colonists, and the most remarkable for the physical history of the country. The city of Cumana was entirely destroyed, the houses were overturned in the space of a few minutes, and the shocks were hourly repeated during fourteen months. In several parts of the province the earth opened, and threw out sulphureous waters. These irruptions were very frequent in a plain extending towards Casanay, two leagues east of the town of Cariaco, and known by the name of the hollow ground (tierra hueca), because it appears entirely undermined by thermal springs. During the years 1766 and 1767, the inhabitants of Cumana encamped in their streets; and they began to rebuild their houses only when the earthquakes recurred once a-month. What was felt at Quito, immediately after the great catastrophe of Fe bruary 1797, took place on these coasts. While the ground was in a. state of continual oscillation, the atmosphere seemed to dissolve itself into water.

Tradition states that in the earthquake of 1766, as well as in another remarkable one in 1794, the shocks were mere horizontal oscillations; it was only on the disastrous 14th of December, 1797, that for the first time at Cumana the motion was felt by an upheaving of the ground. More than

[^46]Google
four-fifths of the city were then entirely destroyed; and the shock, attended by a very loud subterraneous noise, resembled, as at Riobamba, the explosion of a mine at a great depth. Happily the most violent shock was preceded by a slight undulating motion, so that most of the inhabitants were enabled to escape into the streets, and a small number only perished of those who had assembled in the churches. It is a generally received opinion at Cumana, that the most destructive earthquakes are announced by very feeble oscillations, and by a hollow sound, which does not escape the observation of persons habituated to this kind of phenomenon. In those fatal moments the cries of ' misericordia! tembla! tembla!'* are everywhere heard; and it rarely happens that a false alarm is given by a native. Those who are most apprehensive attentively observe the motions of dogs, goats, and swine. The last-mentioned animals, endowed with delicate olfactory nerves, and accustomed to turn up the earth, give warning of approaching danger by their restlessness and their cries. We shall not attempt to decide, whether, being nearer the surface of the ground, they are the first to hear the subterraneous noise; or whether their organs receive the impression of some gaseous emanation which issues from the earth. We cannot deny the possibility of this latter cause. During my abode at Peru, a fact was observed in the inland country, which has an analogy with this kind of phenomenon, and which is not unfrequent. At the end of violent earthquakes, the herbs that cover the savannahs of Tucuman acquired noxious properties; an epidemic disorder broke out among the cattle, and a great number of them appeared stupified or suffocated by the deleterious vapours exhaled from the ground.

At Cumana, half an hour before the catastrophe of the 14th of December, 1797, a strong smell of sulphur was perceived near the hill of the convent of San Francisco; and on the same spot the subterraneous noise, which seemed to proceed from south-east to north-west, was loudest. At the same time flames appeared on the banks of the Manzanares, near the hospital of the Capuchins, and in the gulf of Cariaco, near Mariguitar. This last phenomenon, so extra-

[^47]ordinary in a country not volcanic, is pretty frequent in the Alpine calcareous mountains near Cumanacoa, in the valley of Bordones, in the island of Margareta, and amidst the Llanos or savannahs of New Andalusia. In these savannahs, flakes of fire rising to a considerable height, are seen for hours together in the dryest places; and it is asserted, that, on examining the ground no crevice is perceptible. This fire, which resembles the springs of hydrogen, or Salse, of Modena, or what is called the will-o'-the-wisp of our marshes, does not burn the grass; because, no doubt, the column of gas, which developes itself, is mixed with azote and carbonic acid, and does not burn at its basis. The people, although less superstitious here than in Spain, call these reddish flames by the singular name of 'the soul of the tyrant Aguirre;' imagining that the spectre of Lopez Aguirre, harassed by remorse, wanders over these countries sullied by his crimes.*

The great earthquake of 1797 produced some changes in the configuration of the shoal of Morro Roxo, towards the mouth of the Rio Bordones. Similar swellings were observed at the time of the total destruction of Cumana, in 1766. At that period, the Punta Delgado, on the southern coast of the gulf of Cariaco, became perceptibly enlarged; and in the Rio Guarapiche, near the village of Maturin, a shoal was formed, no doubt by the action of the elastic fluids, which displaced and raised up the bed of the river.

In order to follow a plan conformable to the end we proposed in this work, we shall endeavour to generalize our ideas, and to comprehend in one point of view everything that relates to these phenomena, so terrific, and so difficult to explain. If it be the duty of the men of science who visit the Alps of Switzerland, or the coasts of Lapland, to extend our knowledge respecting the glaciers and the aurora borealis, it may be expected that a traveller who

[^48]has journeyed through Spanish America, should have chiefly fixed his attention on volcanoes and earthquakes. Each part

- of the globe is an object of particular study; and when we cannot hope to penetrate the causes of natural phenomena, we ought at least to endeavour to discover their laws, and distinguish, by the comparison of numerous facts, that which is permanent and uniform from that which is variable and accidental.

The great earthquakes, which interrupt the long series of slight shocks, appear to have no regular periods at Cumana. They have taken place at intervals of eighty, a hundred, and sometimes less than thirty years; while on the coasts of Peru, for instance at Lima, a certain regularity has marked the periods of the total destruction of the city. The belief of the inhabitants in the existence of this uniformity has a happy influence on public tranquillity, aud the encouragement of industry. It is generally admitted, that it requires a sufficiently long space of time for the same causes to act with the same energy; but this reasoning is just only inasmuch as the shocks are considered as a local phenomenon; and a particular focus, under each point of the globe exposed to those great catastrophes, is admitted. Whenever new edifices are raised on the ruins of the old, we hear from those who refuse to build, that the destruction of Lisbon on the first day of November, 1755, was soon followed by a second, and not less fatal convulsion, on the 31st of March, 1761.

It is a very ancient opinion,* and one that is commonly received at Cumana, Acapulco, and Lima, that a perceptible connection exists between earthquakes and the state of the atmosphere that precedes those phenomena. But from the great number of earthquakes which I have witnessed to the north and south of the equator; on the continent, and on the seas; on the coasts, and at 2500 toises height; it appears to me that the oscillations are generally very independent of the previous state of the atmosphere. This opinion is entertained by a number of intelligent residents of the Spanish colonies, whose experience extends, if not over a greater space of the globe, at least over a greater number of years,

* Arist. de Meteor. lib. ii, (ed. Duval, tom. i. p. 798). Seneca, Nat. Quæst., lib. vi., c. 12.
than mine. On the contrary, in parts of Europe where earthquakes are rare compared to America, scientific observers are inclined to admit an intimate connection between the undulations of the ground, and certain meteors, which appear simultaneously with them. In Italy for instance, the sirocco and earthquakes are suspected to have some connection; and in London, the frequency of falling-stars, and those southern lights which have since been often observed by Mr. Dalton, were considered as the forerunners of those shocks which were felt from 1748 to 1756.

On days when the earth is shaken by violent shocks, the regularity of the horary variations of the barometer is not disturbed within the tropics. I had opportunities of verifying this observation at Cumana, at Lima, and at Riobamba; and it is the more worthy of attention, as at St. Domingo, (in the town of Cape François,) it is asserted, that a waterbarometer sank two inches and a half immediately before the earthquake of 1770 . It is also related, that, at the time of the destruction of Oran, a druggist fled with his family, because, observing accidentally, a few minutes before the earthquake, the height of the mercury in his barometer, he perceived that the column sank in an extraordinary manner. I know not whether we can give credit to this story; but as it is nearly impossible to examine the variations of the weight of the atmosphere during the shocks, we must be satisfied with observing the barometer before or after these phenomena have taken place.

We can scarcely doubt, that the earth, when opened and agitated by shocks, spreads occasionally gaseous emanations through the atmosphere, in places remote from the mouths of volcanoes not extinct. At Cumana, it has already been observed that flames and vapours mixed with sulphurous acid spring up from the most arid soil. In other parts of the same province, the earth ejects water and petroleum. At Riobamba, a muddy and inflammable mass, called moya, issues from crevices that close again, and accumulates into elevated hills. At about seven leagues from Lisbon, near Colares, during the terrible earthquake of the 1st of November, 1755 , flames and a column of thick smoke were seen to issue from the flanks of the rocks of Alvidras, and, according to some witnesses, from the bosom of the sea.

Elastic fluids thrown into the atmosphere may act locally on the barometer, not by their mass, which is very small, compared to the mass of the atmosphere, but because, at the moment of great explosions, an ascending current is probably formed, which diminishes the pressure of the air. I am inclined to think that in the majority of earthquakes nothing escapes from the agitated earth; and that, when gaseous emanations and vapours are observed, they oftener accompany or follow, than precede the shocks. This circumstance would seem to explain the mysterious influence of earthquakes in equinoctial America, on the climate, and on the order of the dry and rainy seasons. If the earth generally act on the air only at the moment of the shocks, we can conceive why a sensible meteorological change so rarely precedes those great revolutions of nature.

The hypothesis according to which, in the earthquakes of Cumana, elastic fluids tend to escape from the surface of the soil, seems confirmed by the great noise which is heard during the shocks at the borders of the wells in the plain of Charas. Water and sand are sometimes thrown out twenty feet high. Similar phenomena were observed in ancient times by the inhabitants of those parts of Greece and Asia Minor abounding with caverns, crevices, and subterraneous rivers. Nature, in her uniform progress, everywhere suggests the same ideas of the causes of earthquakes, and the means by which man, forgetting the measure of his strength, pretends to diminish the effect of the subterraneous explosions. What a great Roman naturalist has said of the utility of wells and caverns* is repeated in the New World by the most ignorant Indians of Quito, when they show travellers the guaicos, or crevices of Pichincha.

The subterranean noise, so frequent during earthquakes,

[^49]is generally not in the ratio of the force of the shocks. At Cumana it constantly precedes them, while at Quito, and recently at Caracas, and in the West India Islands, a noise like the discharge of a battery was heard a long time after the shocks had ceased. A third kind of phenomenon, the most remarkable of the whole, is the rolling of those subterranean thunders, which last several months, without being accompanied by the least oscillatory motion of the ground.*

In every country subject to earthquakes, the point at which, probably owing to a particular disposition of the stony strata, the effects are most sensibly felt, is considered as the cause and the focus of the shocks. Thus, at Cumana, the hill of the castle of San Antonio, and particularly the eminence on which stands the convent of St. Francis, are believed to contain an enormous quantity of sulphur and other inflammable matter. We forget that the rapidity with which the undulations are propagated to great distances, even across the basin of the ocean, proves that the centre of action is very remote from the surface of the globe. From this same cause no doubt earthquakes are not confined to certain species of rocks, as some naturalists suppose, but all are fitted to propagate the movement. Keeping within the limits of my own experience I may here cite the granites of Lima and Acapulco; the gneiss of Caracas; the micaslate of the peninsula of Araya; the primitive thonschiefer of Tepecuacuilco, in Mexico; the secondary limestones of the Apennines, Spain, and New Andalusia; and finally, the trappean porphyries of the provinces of Quito and Popayan. $\dagger$ In these different places the ground is frequently agitated by the most violent shocks; but sometimes, in the same rock, the superior strata form invincible obstacles to the

* The subterranean thunders (bramidos $y$ truenos subterraneos) of Guanaxuato. The phenomenon of a noise without shocks was observed by the ancients.-Aristot. Meteor., lib. ii., (ed. Duval, p. 802). Pliny, lib. ii., c. 80.
$\dagger$ I might add to the list of secondary rocks, the gypsum of the newest formation, for instance, that of Montmartre, situated on a marine calcareous rock, which is posterior to the chalk.-See the Mémoires de l'Académie, tom. i., p. 341, on the earthquake felt at Paris and its environs in 1681 .
propagation of the motion. Thus, in the mines of Saxony, we have seen workmen hasten up alarmed by oscillations which were not felt at the surface of the ground.

If, in regions the most remote from each other, primitive, secondary, and volcanic rocks, share equally in the convulsive movements of the globe; we cannot but admit also that within a space of little extent, certain classes of rocks oppose themselves to the propagation of the shocks. At Cumana, for instance, before the great catastrophe of 1797, the earthquakes were felt only along the southern and calcareous coast of the gulf of Cariaco, as far as the town of that name; while in the peninsula of A raya, and at the village of Maniquarez, the ground did not share the same agitation. But since December 1797, new communications appear to have been opened in the interior of the globe. The peninsula of Araya is now not merely subject to the same agitations as the soil of Cumana, but the promontory of micaslate, previously free from earthquakes, has become in its turn a central point of commotion. The earth is sometimes strongly shaken at the village of Maniquarez, when on the coast of Cumana the inhabitants enjoy the most perfect tranquillity. The gulf of Cariaco, nevertheless, is only sixty or eighty fathoms deep.

It has been thought from observations made both on the continent and in the islands, that the western and southern coasts are most exposed to shocks. This observation is connected with opinions which geologists have long formed respecting the position of the high chains of mountains, and the direction of their steepest declivities; but the existence of the Cordillera of Caracas, and the frequency of the oscillations on the eastern and northern coast of Terra Firma, in the gulf of Paria, at Carupano, at Cariaco, and at Cumana, render the accuracy of that opinion doubtful.

In New Andalusia, as well as in Chile and Peru, the shocks follow the course of the shore, and extend but little inland. This circumstance, as we shall soon find, indicates an intimate connection between the causes which produce earthquakes and volcanic eruptions. If the earth was most agitated on the coasts, because they are the lowest part of the land, why should not the oscillations be equally strong
and frequent on those vast savannahs or prairies,* which are scarcely eight or ten toises above the level of the ocean?

The earthquakes of Cumana are connected with those of the West India Islands; and it has even been suspected that they have some connection with the volcanic phenomena of the Cordilleras of the Andes. On the 4th of February, 1797, the soil of the province of Quito suffered such a destructive commotion, that near 40,000 natives perished. At the same period the inhabitants of the eastern Antilles were alarmed by shocks, which continued during eight months, when the volcano of Guadaloupe threw out pumicestunes, ashes, and gusts of sulphureous vapours. The eruption of the 27th of September, during which very long-continued subterranean noises were heard, was followed on the 14th of December by the great earthquake of Cumana. Another volcano of the West India Islands, that of St. Vincent, affords an example of these extraordinary connections. This volcano had not emitted flames since 1718, when they burst forth anew in 1812. The total ruin of the city of Caracas preceded this explosion thirty-five days, and violent oscillations of the ground were felt both in the islands and on the coasts of Terra Firma.

It has long been remarked that the effects of great earthquakes extend much farther than the phenomena arising from burning volcanoes. In studying the physical revolutions of Italy, in carefully examining the series of the eruptions of Vesuvius and Etna, we can scarcely recognise, notwithstanding the proximity of these mountains, any traces of a simultaneous action. It is on the contrary beyond a doubt, that at the period of the last and preceding destruction of Lisbon, $\dagger$ the sea was violently agitated even as far as the

[^50]New World, for instance, at the island of Barbadoes, more than twelve hundred leagues distant from the coasts of Portugal.

Several facts tend to prove that the causes which produce earthquakes have a near connection with those which act in volcanic eruptions. The connection of these causes was known to the ancients, and it excited fresh attention at the period of the discovery of America. The discovery of the New World not only offered new productions to the curiosity of man, it also extended the then existing stock of knowledge respecting physical geography, the varieties of the human species, and the migrations of nations. It is impossible to read the narratives of early Spanish travellers, especially that of the Jesuit Acosta, without perceiving the influence which the aspect of a great continent, the study of extraordinary appearances of nature, and intercourse with men of different races, must have exercised near the island of Trinidad. In the West Indies, and in several lakes of Switzerland, this extraordinary motion of the waters was observed six hours after the first shock that was felt at Lisbon.-Phil. Trans., vol. xlix, pp. 403, 410, 544, 668; ibid. vol. liii, p. 424. At Cadiz a mountain of water sixty feet high was seen eight miles distant at sea. This mass threw itself impetuously on the coasts, and beat down a great number of houses; like the wave eighty-four feet ligh, which on the 9th of June, 1586, at the time of the great earthquake of Lima, covered the port of Callao.-Acosta, Hist. Natural de las Indias, ed. de 1591, p. 123. In North America, on Lake Ontario, violent agitations of the water were observed from the month of October 1755. These phenomena are proofs of subterraneous communications at enormous distances. On comparing the periods of the great catastrophes of Lima and Guatimala, which generally succeed each other at long intervals, it has sometimes been thought, that the effect of an action slowly propagating along the Cordilleras, sometimes from north to south, at other times from south to north, may be perceived.-Cosmo Bueno, Descripcion del Peru, ed. de Lima, p. 67. Four of these remarkable catastrophes, with their dates, may be here enumerated.

Mexico.
(Lat. $13^{\circ} 32^{\prime}$ north.)
30th of November, 1577.
4th of March, 1679.
12th of February, 1689. 27th of September, 1717.

Pref.
(Lat. $12^{\circ} 2^{\prime}$ south.) 17th of June, 1578. 17th of June, 1678. 10th of October, 1688. 8th of February, 1716.

When the shocks are not simultaneous, or do not follow each other at short intervals, great doubts may be entertained with respect to the supposed communication of the movement.
on the progress of knowledge in Europe. The germ of a great number of physical truths is found in the works of the sixteenth century; and that germ would have fructified, had it not been crushed by fanaticism and superstition. We learned, at Pasto, that the column of black and thick smoke, which, in 1797, issued for several months from the volcano near that shore, disappeared at the very hour, when, sixty leagues to the south, the towns of Riobamba, Hambato, and Tacunga were destroyod by an enormous shock. In the interior of a burning crater, near those hillocks formed by ejections of scorim and ashes, the motion of the ground is felt several seconds before each partial eruption takes place. We observed this phenomenon at Vesuvius in 1805, while the mountain threw out incandescent scoriæ; we were witnesses of it in 1802, on the brink of the immense crater of Pichincha, from which, nevertheless, at that time, clouds of sulphureous acid vapours only issued.

Everything in earthquakes seems to indicate the action of elastic fluids seeking an outlet to diffuse themselves in the atmosphere. Often, on the coasts of the Pacific, the action is almost instantaneously communicated from Chile to the gulf of Guayaquil, a distance of six hundred leagues; and, what is very remarkable, the shocks appear to be the stronger in proportion as the country is distant from burning volcanoes. The granitic mountains of Calabria, covered with very recent breccias, the calcareous chain of the Apennines, the country of Pignerol, the coasts of Portugal and Greece, those of Peru and Terra Firma, afford striking proofs of this fact. The globe, it may be said, is agitated with the greater force, in proportion as the surface has a smaller number of funnels communicating with the caverns of the interior. At Naples and at Messina, at the foot of Cotopaxi and of Tunguragua, earthquakes are dreaded only when vapours and flames do not issue from the craters. In the kingdom of Quito, the great catastrophe of Riobamba led several well-informed persons to think that that country would be less frequently disturbed, if the subterranean fire should break the porphyritic dome of Chimborazo; and if that colossal mountain should become a burning volcano. At all times analogous facts have led to the same hypotheses. The Greeks, who, like ourselves, attributed the oscillations
of the ground to the tension of elastic fluids, cited in favour of their opinion, the total cessation of the shocks at the island of Eubœa, by the opening of a crevice in the Lelantine plain.*

The phenomena of volcanoes, and those of earthquakes, have been considered of late as the effects of voltaic electricity, developed by a particular disposition of heterogeneous strata. It cannot be denied, that often, when violent shocks succeed each other within the space of a few hours, the electricity of the air sensibly increases at the instant the ground is most agitated; but to explain this phenomenon, it is unnecessary to recur to an hypothesis, which is in direct contradiction to everything hitherto observed respecting the structure of our planet, and the disposition of its strata.

## Chapter V. <br> Peninsula of Araya.-Salt-marshes.-Ruins of the Castle of Santiago.

The first weeks of our abode at Cumana were employed in testing our instruments, in herborizing in the neighbouring plains, and in examining the traces of the earthquake of the 14th of December, 1797. Overpowered at once by a great number of objects, we were somewhat embarrassed how to lay down a regular plan of study and observation. Whilst every surrounding object was fitted to inspire in us the most lively interest, our physical and astronomical instruments in their turns excited strongly the curiosity of the inhabitants. We had numerous visitors; and in our desire to satisfy persons who appeared so happy to see the spots of the moon through Dollond's telescope, the absorption of two gases in a eudiometrical tube, or the effects of galvanism on the motions of a frog, we were obliged to answer questions often obscure, and to repeat for whole hours the same experiments. These scenes were renewed for the space of five years, whenever we took up our abode in a place where it was understood

[^51]that we were in possession of microscopes, telescopes, and electrical apparatus.

I could not begin a regular course of astronomical observations before the 28th of July, though it was highly important for me to know the longitude given by Berthoud's time-keeper; but it happened, that in a country where the sky is constantly clear and serene, no stars appeared for several nights. The whole series of the observations I made in 1799 and 1800 give for their results, that the latitude of the great square at Cumana is $10^{\circ} 27^{\prime} 52^{\prime \prime}$, and its longitude $66^{\circ} 30^{\prime} 2^{\prime \prime}$. This longitude is founded on the difference of time, on lunar distances, on the eclipse of the sun (on the 28th of October, 1799), and on ten immersions of Jupiter's satellites, compared with observations made in Europe. The oldest chart we have of the continent, that of Don Diego Ribeiro, geographer to the emperor Charles the Fifth, places Cumana in latitude $9^{\circ} 30^{\circ}$; which differs fifty-eight minutes from the real latitude, and half a degree from that marked by Jefferies in his American Pilot, published in 1794. During three centuries the whole of the coast of Terra Firma has been laid down too far to the south: this has been owing to the current near the island of Trinidad, which sets toward the north, and mariners are led by their dead-reckoning to think themselves farther south than they really are.

On the 17th of August a halo round the moon fixed the attention of the inhabitants of Cumana, who considered it as the presage of some violent earthquake; for, according to popular notions, all extraordinary phenomena are immediately connected with each other. Coloured circles around the moon are much more rare in northern countries, than in Provence, Italy, and Spain. They are seen particularly (and this fact is singular enough) when the sky is clear, and the weather seems to be most fair and settled. Under the torrid zone beautiful prismatic colours appear almost every night, and even at the time of the greatest droughts; often in the space of a few minutes they disappear several times, because, doubtless, the superior currents change the state of the floating vapours, by which the light is refracted. I sometimes even observed, between the fifteenth degree of latitude and the equator, small halos
around the planet Venus; the purple, orange, and violet, were distinctly perceived: but I never saw any colours around Sirius, Canopus, or Acherner.

While the halo was visible at Cumana, the hygrometer denoted great humidity; nevertheless the vapours appeared so perfectly in solution, or rather so elastic and uniformly disseminated, that they did not alter the transparency of the atmosphere. The moon arose after a storm of rain, behind the castle of San Antonio. As soon as she appeared on the horizon, we distinguished two circles : one large and whitish, forty-four degrees in diameter; the other a small circle of $1^{\circ} 43^{\prime}$, displaying all the colours of the rainbow. The space between the two circles was of the deepest azure. At four degrees height, they disappeared, while the meteorological instruments indicated not the slightest change in the lower regions of the air. This phenomenon had nothing extraordinary, except the great brilliancy of the colours, added to the circumstance, that, according to the measures taken with Ramsden's sextant, the lunar disk was not exactly in the centre of the halos. Without this actual measurement we might have thought that the excentricity was the effect of the projection of the circles on the apparent concavity of the sky.

If the situation of our house at Cumana was highly favourable for the observation of the stars and meteorological phenomena, it obliged us to be sometimes the witnesses of painful scenes during the day. A part of the great square is surrounded with arcades, above which is one of those long wooden galleries, common in warm countries. This was the the place where slaves, brought from the coast of Africa, were sold. Of all the European governments Denmark was the first, and for a long time the only power, which abolished the traffic; yet notwithstanding that fact, the first negroes we saw exposed for sale had been landed from a Danish slave-ship. What are the duties of humanity, national honour, or the laws of their country, to men stimulated by the speculations of sordid interest?

The slaves exposed to sale were young men from fifteen to twenty years of age. Every morning cocoa-nut oil was distributed among them, with which they rubbed their
bodies, to give their skin a black polish. The persons who came to purchase examined the teeth of these slaves, to judge of their age and health; forcing open their mouths as we do those of horses in a market. This odious custom dates from Africa, as is proved by the faithful pictures drawn by the inimitable Cervantes,* who after his long captivity among the Moors, described the sale of Christian slaves at Algiers. It is distressing to think that even at this day there exist European colonists in the West Indies who mark their slaves with a hot iron, to know them again if they escape. This is the treatment bestowed on those "who save other men the labour of sowing, tilling, and reaping." $\dagger$

In 1800 the number of slaves did not exceed six thousand in the two provinces of Cumana and Barcelona, when at the same period the whole population was estimated at one hundred and ten thousand inhabitants. The trade in African slaves, which the laws of the Spaniards have never favoured, is almost as nothing on these coasts where the trade in American slaves was carried on in the sixteenth century with desolating activity. Macarapan, anciently called Amaracapana, Cumana, Araya, and particularly New Cadiz, built on the islet of Cubagua, might then be considered as commercial establishments for facilitating the slave trade. Girolamo Benzoni of Milan, who at the age of twenty-two visited Terra Firma, took part in some expeditions in 1542 to the coasts of Bordones, Cariaco, and Paria, to carry off the unfortunate natives. He relates with simplicity, and often with a sensibility not common in the historians of that time, the examples of cruelty of which he was a witness. He saw the slaves dragged to New Cadiz, to be marked on the forehead and on the arms, and for the payment of the quint to the officers of the crown. From this port the Indians were sent to the island of Hayti or St. Domingo, after having often changed masters, not by

* El Trato de Argel. Jorn. II. Viage al Parnasso (1784), p. 316.
$\dagger$ La Bruyère, Caractères, chap. xi. (ed. 1765), p. 300. I will here cite a passage strongly characteristic of La Bruyère's benevolent feeling for his fellow-creatures. "We find (under the torrid zone) certain wild animals, male and female, scattered through the country, black, livid, and all over scorched by the sun, bent to the earth which they dig and turn up with invincible perseverance. They have something like articulate utterance; and when they stand up on their feet, they exhibit a human face, and in fact these creatures are men."
way of sale, but because the soldiers played for them at dice.

The first excursion we made was to the peninsula of Araya, and those countries formerly celebrated for the slave-trade and the pearl-fishery. We embarked on the Rio Manzanares, near the Indian suburb, on the 19th of August, about two in the morning. The principal objects of this excursion were, to see the ruins of the castle of Araya, to examine the salt-works, and to make a few geological observations on the mountains forming the narrow peninsula of Maniquarez. The night was delightfully cool; swarms of phosphorescent insects* glistened in the air, and over a soil covered with sesuvium, and groves of mimosa which bordered the river. We know how common the glow-worm $\dagger$ is in Italy and in all the south of Europe, but the picturesque effect it produces cannot be compared to those innumerable, scattered, and moving lights, which embellish the nights of the torrid zone, and seem to repeat on the earth, along the vast extent of the savannahs, the brilliancy of the starry vault of heaven.

When, on descending the river, we drew near plantations, or charas, we saw bonfires kindled by the negroes. A light and undulating smoke rose to the tops of the palm-trees, and imparted a reddish hue to the disk of the moon. It was on a Sunday night, and the slaves were dancing to the music of the guitar. The people of Africa, of negro race, are endowed with an inexhaustible store of activity and gaiety. After having ended the labours of the week, the slaves, on festival days, prefer to listless sleep the recreations of music and dancing.

The bark in which we passed the gulf of Cariaco was very spacious. Large skins of the jaguar, or American tiger, were spread for our repose during the night. Though we had yet scarcely been two months in the torrid zone, we had already become so sensible to the smallest variation of temperature that the cold prevented us from sleeping; while, to our surprise, we saw that the centigrade thermometer was as high as $21.8^{\circ}$. This fact is familiar to those who have lived long in the Indies, and is worthy the

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attention of physiologists. Bouguer relates, that when he reached the summit of Montagne Pelée, in the island of Martinique, he and his companions shivered with cold, though the heat was above $21.5^{\circ}$. In reading the interesting narrative of captain Bligh, who, in consequence of a mutiny on board the Bounty, was forced to make a voyage of twelve hundred leagues in an open boat, we find that that navigator, in the tenth and twelfth degrees of south latitude, suffered much more from cold than from hunger. During our abode at Guayaquil, in the month of January 1803, we observed that the natives covered themselves, and complained of the cold, when the thermometer sunk to $23.8^{\circ}$, whilst they felt the heat suffocating at $30.5^{\circ}$. Six or seven degrees were sufficient to cause the opposite sensations of cold and heat; because, on these coasts of South America, the ordinary temperature of the atmosphere is twenty-eight degrees. The humidity, which modifies the conducting power of the air for heat, contributes greatly to these impressions. In the port of Guayaquil, as everywhere else in the low regions of the torrid zone, the weather grows cool only after storms of rain: and I have observed that when the thermometer sinks to $23.8^{\circ}$, De Luc's hygrometer keeps up to fifty and fifty-two degrees; it is, on the contrary, at thirty-seven degrees in a temperature of $30.5^{\circ}$. At Cumana, during very heavy showers, people in the streets are heard exclaiming, que hielo! estoy emparamado;* though the thermometer

[^53]exposed to the rain sinks only to $21 \cdot 5^{\circ}$. From these observations it follows, that between the tropics, in plains where the temperature of the air is in the day-time almost invariably above twenty-seven degrees, warmer clothing during the might is requisite, whenever in a damp air the thermometer sinks four or five degrees.

We landed about eight in the morning at the point of Araya, near the new salt-works. A solitary house, near a battery of three guns, the only defence of this coast, since the destruction of the fort of Santiago, is the abode of the inspector. It is surprising that these salt-works, which formerly excited the jealousy of the English, Dutch, and other maritime powers, have not created a village, or even a farm; a few huts only of poor Indian fishermen are found at the extremity of the point of Araya.

This spot commands a view of the islet of Cubagua, the lofty hills of Margareta, the ruins of the castle of Santiago, the Cerro de la Vela, and the calcareous chain of the Brigantine, which bounds the horizon towards the south. I availed myself of this view to take the angles between these different points, from a basis of four hundred toises, which I measured between the battery and the hill called the Peña. As the Cerro de la Vela, the Brigantine, and the castle of San Antonio at Cumana, are equally visible from the Punta Arenas, situated to the west of the village of Maniquarez, the same objects were available for an approximate determination of the respective positions of several points, which are laid down in the mineralogical chart of the peninsula of Araya.

The abundance of salt contained in the peninsula of Araya was known to Alonzo Niño, when, following the tracks of Columbus, Ojeda, and Amerigo Vespucci, he visited these countries in 1499. Though of all the people on the globe the natives of South America consume the least salt, because they scarcely eat anything but vegetables, it nevertheless appears, that at an early periud the Guayquerias dug into the clayey and muriatiferous soil of Punta Arenas Even the brine-pits, now called new, (la satina nueva,)

[^54]situated at the extremity of Capo Araya, were worked in very remote times. The Spaniards, who settled at first at Cubagua, and soon after on the coasts of Cumana, worked, from the beginning of the sixteenth century, the salt marshes which stretch away like a lagoon to the north of Cerro de la Vela. As at that period the peninsula of Araya had no settled population, the Dutch availed themselves of the natural riches of a soil which appeared to be property common to all nations. In our days, each colony has its own salt-works, and navigation is so much improved, that the merchants of Cadiz can send, at a small expense, salt from Spain and Portugal to the southern hemisphere, a distance of 1900 leagues, to cure meat at Monte Video and Buenos Ayres. These advantages were unknown at the time of the conquest; colonial industry had then made so little progress, that the salt of Araya was carried, at great expense, to the West India Islands, Carthagena, and Portobello. In 1605, the court of Madrid sent armed ships to Punta Araya, with orders to expel the Dutch by force of arms. The Dutch, however, continued to carry on a contraband trade in salt till, in 1622, there was built near the salt-works a fort, which afterwards became celebrated under the name of the Castillo de Santiago, or the Real Fuerza de Araya. The great saltmarshes are laid down on the oldest Spanish maps, sometimes as a bay, and at other times as a lagoon. Laet, who wrote his Orbis Noous in 1633, and who had some excellent notions respecting these coasts, expressly states, that the lagoon was separated from the sea by an isthmus above the level of high water. In 1726, an impetuous hurricane destroyed the salt-works of Araya, and rendered the fort, the construction of which had cost more than a million of piastres, useless. This hurricane was a very rare phenomenon in these regions, where the sea is in general as calm as the water in our large rivers. The waves overflowed the land to a great extent; and by the effect of this eruption of the ocean the salt lake was converted into a gulf several miles in length. Since that period, artificial reservoirs, or pits, (vasets,) have been formed, to the north of the range of hills which separates the castle from the north coast of the peninsula.

The consumption of salt amounted, in 1799 and 1800, in the two provinces of Cumana* and Barcelona, to nine or ten thousand fanegas, each sixteen arrobas, or four hundredweight. This consumption is very considerable, and gives, if we deduct from the total population fifty thousand Indians, who eat very little salt, sixty pounds for each person. Salt beef, called tasajo, is the most important article of export from Barcelona. Of nine or ten thousand fanegas furnished by the two provinces conjointly, three thousand only are produced by the salt-works of Araya; the rest is extracted from the sea-water at the Morro of Barcelona, at Pozuelos, at Piritu, and in the Golfo Triste. In Mexico, the salt lake of Peñon Blanco alone furnishes yearly more than two hundred and fifty thousand fanegas of unpurified salt.

The province of Caracas possesses fine salt-works at Los Roques; those which formerly existed at the small island of Tortuga, where the soil is strongly impregnated with muriate of soda, were destroyed by order of the Spanish government. A canal was made by which the sea has free access to the salt-marshes. Foreign nations who have colonies in the West Indies frequented this uninhabited island; and the court of Madrid, from views of suspicious policy, was apprehensive that the salt-works of Tortuga would give rise to settlements, by means of which an illicit trade would be carried on with Terra-Firma.

The royal administration of the salt-works of Araya dates only from the year 1792. Before that period they were in the hands of Indian fishermen, who manufactured salt at

- At the period of my visit to that country the government of Cumana comprehended the two provinces of New Andalusia and New Barcelona. The words province and govierno, or government of Cumana, are consequently not synonymous. A Catalonian, Juan de Urpin, who had been by turns a canon, a doctor of laws, a counsellor in St. Domingo, and a private soldier in the castle of Araya, founded in 1636, the city of New Barcelona, and attempted to give the name of New Catalonia (Nueva Cathaluña) to the province of which this newly constructed city became the capital. This attempt was fruitless; and it is from the capital that the whole province took its name. Since my departure from America, it has been raised to the rank of a Govierno. In New Andalusia, the Indian name of Cumana has superseded the names Nueva Toledo and Nueva Cordoba, which we find on the maps of the seventeenth century.
their pleasure, and sold it, paying the government the moderate sum of three hundred piastres. The price of the fanega was then four reals;* but the salt was extremely impure, grey, mixed with earthy particles, and surcharged with muriate and sulphate of magnesia. Since the prorince of Cumana has become dependent on the intendancia of Caracas, the sale of salt is under the control of the excise; and the fanega, which the Guayquerias sold at half a piastre, costs a piastre and a half. $\dagger$ This augmentation of price is slightly compensated by greater purity of the salt, and by the facility with which the fishermen and farmers can procure it in abundance during the whole year. The salt-works of Araya yielded to the treasury, in 1799, a clear income of eight thousand piastres.

Considered as a branch of industry the salt produced here is not of any great importance, but the nature of the soil which contains the salt-marshes is well worthy of attention. In order to obtain a clear idea of the geological connection existing between this muriatiferous soil and the rocks of more ancient formation, we shall take a general view of the neighbouring mountains of Cumana, and those of the peninsula of Araya, and the island of Margaretta.

Three great parallel chains extend from east to west. The two most northerly chains are primitive, and contain the mica-slates of Macanao, and the San Juan Valley, of Maniquarez, and of Chuparipari. These we shall distinguish by the names of Cordillera of the island of Margareta, and Cordillera of Araya. The third chain, the most southerly of the whole, the Cordillera of the Brigantine and of the Cocollar, contains rocks only of secondary formation; and, what is remarkable enough, though analogous to the geological constitution of the Alps westward of St. Gothard, the primitive chain is much less elevated than that which was composed of

[^55]secondary rocks.* The sea has separated the two northern Cordilleras, those of the island of Margareta and the peninsula of Araya; and the small islands of Coche and of Cubague are remnants of the land that was submerged. Farther to the south, the vast gulf Cariaco stretches away, like a longitudinal valley formed by the irruption of the sea, between the two small chains of Araya and the Cocollar, between the mica-slate and the Alpine limestone. We shall soon see that the direction of the strata, very regular in the first of these rocks, is not quite parallel with the general direction of the gulf. In the high Alps of Europe, the great longitudinal valley of the Rhone also sometimes cuts at an oblique angle the calcareous banks in which it has been excavated.

The two parallel chains of Araya and the Cocollar were connected, to the east of the town of Cariaco, between the lakes of Campoma and Putaquao, by a kind of transverse dyke, which bears the name of Cerro de Meapire, and which in distant times, by resisting the impulse of the waves, has hindered the waters of the gulf of Cariaco from uniting with those of the gulf of Paria. Thus, in Switzerland, the central chain, that which passes by the Col de Ferrex, the Simplon, St. Gothard, and the Splügen, is connected on the north and the south with two lateral chains, by the mountains of Furca and Maloya. It is interesting to recall to mind those striking analogies exhibited in both continents by the external structure of the globe.

The primitive chain of Araya ends abruptly in the meridian of the village of Maniquarez; and the western slope of the peninsula, as well as the plains in the midst of which stands the castle of San Antonio, is covered with very recent formations of sandstone and clay mixed with gypsum. Near Maniquarez, breccia or sandstone with calcareous cement,

* In New Andalusia, the Cordillera of the Cocollar nowhere contains primitive rocks. If these rocks form the nucleus of this chain, and rise above the level of the neighbouring plains, which is scarcely probable, we must suppose that they are all covered with limestone and sandstone. In the Swiss Alps, on the contrary, the chain which is designated under the too vague denomination of lateral and calcareous, contains primitive rocks, which, according to the observations of Escher and Leopold von Buch, are often visible to the height of eight hundred or a thousand toises.
which might easily be confounded with real limestone, lies immediately over the mica-slate; while on the opposite side, near Punta Delgada, this sandstone covers a compact bluish gray limestone, almost destitute of petrifactions, and traversed by small veins of calcareous spar. This last rock is analogous to the limestone of the high Alps.*

The very recent sandstone formation of the peninsula of Araya contains:-first, near Punta Arenas, a stratified sandstone, composed of very fine grains, united by a calcareous cement in small quantity ;-secondly, at the Cerro de la Vela, a schistose sandstone, $\dagger$ without mica, and passing into slateclay, $\ddagger$ which accompanies coal :-thirdly, on the western side, between Punta Gorda and the ruins of the castle of Santiago, breccia composed of petruied sea-shells united by a calcareous cement, in which are mingled grains of quartz ;-fourthly, near the point of Barigon, whence the stone employed for building at Cumana is obtained, banks of yellowish white shelly limestone, in which are found some scattered grains of quartz;-fifthly, at Peñas Negras, at the top of the Cerro de la Vela, a bluish gray compact limestone, very tender, almost without petrifactions, and covering the schistose sandstone. However extraordinary this mixture of sandstone and compact limestone§ may appear, we camot doubt that these strata belong to one and the same formation. The very recent secondary rocks everywhere present analogous phenomena; the molasse of the Pays de Vaud contains a fetid shelly limestone, and the cerite limestone of the banks of the Seine is sometimes mixed with sandstone.

The strata of calcareous breccia are composed of an infinite number of sea-shells, from four to six inches in diameter, and in part well preserved. We find they contain not ammonites, but ampullaires, solens, and terebratulæ. The greater part of these shells are mixed: the oysters and pectinites being sometimes arranged in families. The whole are easily detached, and their interior is filled with fossil madrepores and cellepores. We have now to speak of a fourth formation, which probably rests $\|$ on the calcareous

[^56]sandstone of Araya, I mean the muriatiferous clay. This clay, hardened, impregnated with petroleum, and mixed with lamellar and lenticular gypsum, is analogous to the salzthon, which in Europe accompanies the sal-gem of Berchtesgaden, and in South America that of Zipaquira. It is generally of a smoke-grey colour, earthy, and friable; but it encloses more solid masses of a blackish brown, of a schistose, and sometimes conchoidal fracture. These fragments, from six to eight inches long, have an angular form. When they are very small, they give the clay a porphyroidal appearance. We find disseminated in it, as we have already observed, either in nests or in small veins, selenite, and sometimes, though seldom, fibrous gypsum. It is remarkable enough, that this stratum of clay, as well as the banks of pure salgem and the salzthon in Europe, scarcely ever contains shells, while the rocks adjacent exhibit them in great abundance.

Although the muriate of soda is not found visible to the eye in the clay of Araya, we cannot doubt of its existence. It shows itself in large crystals, if we sprinkle the mass with rain-water and expose it to the sun. The lagoon to the east of the castle of Santiago exhibits all the phenomena which have been observed in the salt lakes of Siberia, described by Lepechin, Gmelin, and Pallas. This lagoon receives, however, only the rain-waters, which filter through the banks of clay, and unite at the lowest point of the peninsula. While the lagoon served as a salt-work to the Spaniards and the Dutch, it did not communicate with the sea; at present this communication has been interrupted anew, by faggots placed at the place where the waters of the ocean made an irruption in 1726. After great droughts, crystallized and very pure muriate of soda, in masses of three or four cubic feet, is still drawn from time to time from the bottom of the lagoon. The salt waters of the lake, exposed
rests on a slate-clay, mixed with quartzose sand; but there is no proof of the muriatiferous clay of the salt-works being of more ancient formation than this slate-clay, or of its alternating with banks of sandstone. No well having been dug in these countries, we can have no information respecting the superposition of the strata. The banks of calcareous sandstone, which are found at the mouth of the salt lake, and near the fishermen's huts on the coast opposite Cape Macano, appeared to me to lie beneath the muriatiferous clay.
to the heat of the sun, evaporate at their surface; crusts of salt, formed in a saturated solution, fall to the bottom; and by the attraction between chrystals of a similar nature and form, the crystallized masses daily augment. It is generally observed that the water is brackish wherever lagoons are formed in clayey ground. It is true, that for the new salt-work near the battery of Araya, the seawater is received into pits, as in the salt marshes of the south of France; but in the island of Margareta, near Pampatar, salt is manufactured by employing only fresh water, with which the muriatiferous clay has first been lixivated.

We must not confound the salt disseminated in these elayey soils with that contained in the sands of the seashore, on the coasts of Normandy. These phenomena, considered in a geognostical point of view, have scarcely any properties in common. I have seen muriatiferous clay at the level of the ocean at Punta Araya, and at two thousand toises' height in the Cordilleras of New Grenada. If in the former of these places it lies on very recent shelly breccia, it forms, on the contrary, in Austria near Ischel, a considerable stratum in the Alpine limestone, which, though equally posterior to the existence of organic life on the globe, is nevertheless of high antiquity, as is proved by the great number of rocks with which it is covered. We shall not question, that sal-gem, either pure or mixed with muriatiferous clay, may have been deposited by an ancient sea; but everything evinces that it was formed during an order of things bearing no resemblance to that in which the sea at present, by a slower operation, deposits a few particles of muriate of soda on the sands of our shores. In the same manner as sulphur and coal belong to periods of formation very remote from each other, the sal-gem is also found sometimes in transition gypsum," sometimes in the Alpine limestonet, sometimes in a muriatiferous clay lying on a very

[^57]recent sandstone*, and lastly, sometimes in a gypsum $\dagger$ pos terior to the chalk.

The new salt-works of Araya have five reservoirs, or pits, the largest of which have two thousand three hundred square toises surface. Their mean depth is eight inches. Use is made both of the rain-water, which by filtration collects at the lowest part of the plain, and of the water of the sea, which enters by canals, or martellières, when the flood-tide is favoured by the winds. The situation of these new salt-works is less advantageous than that of the lagdon. The waters which fall into the latter pass over steeper slopes, washing a greater extent of ground.

The earth already lixiviated is never carried away here, as it is from time to time in the island of Margareta; nor have

## * At Punta Araya.

+ Gypsum of the third formation among the secondary gypsums. The first formation contains the gypsum in which are found the brine-springs of Thuringia, and which is placed either in the Alpine limestone or zechstein, to which it essentially belongs (Freiesleben, Geognost. Arbeiten, tom. ii. p. 131), or between the zechstein and the limestone of the Jura, or between the zechstein and the new sandstone. It is the ancient gypsum of secondary formation of Werner's school (älterer flözgyps), which we almost preferably call muriatiferous gypsum. The second formation is composed of fibrous gypsum, placed either in the molasse or new sandstone, or between this and the upper limestone. It abounds in common clay, which differs essentially from the salzthon or muriatiferous clay. The third formation of gypsum is more recent than chalk. To this belongs the bony gypsum of Paris; and, as appears from the researches of Mr. Steffens (Geogn. Aufsatsze, 1810, p. 142), the gypsum of Segeberg, in Holstein, in which sal-gem is sometimes disseminated in very small nests (Jenaische Litteratur-Zeitung, 1813, p. 100). The gypsum of Paris, lying between a cerite limestone, which covers chalk and a sandstone without shells, is distinguished by fossil bones of quadrupeds, while the Segeberg and Lunebourg gypsums, the position of which is more uncertain, are characterized by the boracits which they contain. Two other formations, far anterior to the three we have just mentioned, are the transition gypsum (übergangsgyps) of Aigle, and the primitive gypsum (urgyps) of the valley of Canaria, near Airolo. I flatter myself that I may render some service to those geologists who prefer the knowledge of positive facts to speculation on the origin of things, by furnishing them with materials from which they may generalize their ideas on the formation of rocks in both hemispheres. The relative antiquity of the formations is the principal object of a science which is to render us acquainted with the structure of the globe; that is to say, the nature of the strata which constitute the crust of our planet.
wells been dug in the muriatiferous clay, with the view of finding strata richer in muriate of soda. The salineros, or salt-workers generally complain of want of rain; and in the new salt-works, it appears to me difficult to determine what quantity of salt is derived solely from the waters of the sea. The natives estimate it at a sixth of the total produce. The evaporation is extremely strong, and favoured by the constant motion of the air; so that the salt is collected in eighteen or twenty days after the pits are filled.

Though the muriate of soda is manufactured with less care in the peninsula of Araya than at the salt-works of Europe, it is nevertheless purer, and contains less of earthy muriates and sulphates. We know not whether this purity may be attributed to that portion of the salt which is furnished by the sea; for though it is extremely probable, that the quantity of salt dissolved in the waters of the ocean is nearly the same under every zone, it is not less un-- certain whether the proportion between the muriate of soda, the muriate and sulphate of magnesia, and the sulphate and carbonate of lime, be equally invariable.

Having examined the salt-works, and terminated our geodesical operations, we departed at the decline of day to sleep at an Indian hut, some miles distant, near the ruins of the castle of Araya. Directing our course southward, we traversed first the plain covered with muriatiferous clay, and stripped of vegetation; then twö chains of hills of sandstone, between which the lagoon is situated. Night overtook us while we were in a narrow path, bordered on one side by the sea, and on the other by a range of perpendicular rocks. The tide was rising rapidly, and narrowed the road at every step. We at length arrived at the foot of the old castle of Araya, where we enjoyed a prospect that had in it something lugubrious and romantic. The ruins stand on a bare and arid mountain, crowned with agave, columnar cactus, and thorny mimosas: they bear less resemblance to the works of man, than to those masses of rock which were ruptured at the early revolutions of the globe.

We were desirous of stopping to admire this majestic spectacle, and to observe the setting of Venus, whose disk appeared at intervals between the yawning crannies of the
castle; but the muleteer, who served as our guide, was parched with thirst, and pressed us earnestly to return. He had long perceived that we had lost our way; and as he hoped to work on our fears he continually warned us of the danger of tigers and rattlesnakes. Venomous reptiles are, indeed, very common near the castle of Araya; and two jaguars had been lately killed at the entrance of the village of Maniquarez. If we might judge from their skins, which were preserved, their size was not less than that of the Indian tiger. We vainly represented to our guide that those animals did not attack men where the goats furnished them with abundant prey; we were obliged to yield, and return. After having proceeded three quarters of an hour along a shore covered by the tide we were joined by the negro, who carried our provision. Uneasy at not seeing us arrive, he had come to meet us, and he led us through a wood of nopals to a hut inhabited by an Indian family. We were received with the cordial hospitality observed in this country among people of every tribe. The hut in which we slung our hammocks was very clean; and there we found fish, plantains, and what in the torrid zone is preferable to the most sumptuous food, excellent water.

The next day at sunrise we found that the hut in which we had passed the night formed part of a group of small dwellings on the borders of the salt lake, the remains of a Considerable village which had formerly stood near the castle. The ruins of a church were seen partly buried in the sand, and covered with brushwood. When, in 1762, to save the expense of the garrison, the castle of Araya was totally dismantled, the Indians and Mulattoes who were settled in the neighbourhood emigrated by،degrees to Maniquarez, to Cariaco, and in the suburb of the Guayquerias at Cumana. A small number, bound from affection to their native soil, remained in this wild and barren spot. These poor people live by catching fish, which are extremely abundant on the coast and the neighbouring shoals. They appear satisfied with their condition, and think it strange when they are asked why they have no gardens or culinary vegetables. Our gardens, they reply, are beyond the gulf; when we carry our fish to Cumana, we bring back plantains, cocoa nuts, and cassava. This system of economy, which favours
idleness, is followed at Maniquarez, and throughout the whole peninsula of Araya. The chief wealth of the inhabitants consists in goats, which are of a very large and very fine breed, and rove in the fields like those at the Peak of Teneriffe. They have become entirely wild, and are marked like the mules, because it would be difficult to recognize them from their colour or the arrangement of their spots. These wild goats are of a brownish yellow, and are not varied in colour like domestic animals. If in hunting, a colonist kills a goat which he does not consider as his own property, he carries it immediately to the neighbour to whom it belongs. During two days we heard it everywhere spoken of as a very extraordinary circumstance, that an inhabitant of Maniquarez had lost a goat, on which it was probable that a neighbouring family had regaled themselves.

Among the Mulattoes, whose huts surround the salt lake, we found a shoemaker of Castilian descent. He received us with the air of gravity and self-sufficiency which in those countries characterize almost all persons who are conscious of possessing some peculiar talent. He was employed in stretching the string of his bow, and sharpening his arrows to shoot birds. His trade of a shoemaker could not be very lucrative in a country where the greater part of the inhabitants go barefooted; and he only complained that, on account of the dearness of European gunpowder, a man of his quality was reduced to employ the same weapons as the Indians. He was the sage of the plain; he understood the formation of the salt by the influence of the sun and full moon, the symptoms of earthquakes, the marks by which mines of gold and silver are discovered, and the medicinal plants, which, like all the other colonists from Chile to California, he classified into hot and cold.* Having collected the traditions of the country, he gave us some curious accounts of the pearls of Cubagua, objects of luxury, which he treated with the utmost contempt. To show us how familiar to him were the sacred writings he took a pride in reminding us that Job preferred wisdom to all the pearls of the Indies. His philosophy was circumscribed to the narrow circle of the wants of life. The possession of a very strong ass, able

* Exciting or debilitating, the sthenic and asthenic, of Brown's system.
to carry a heary load of plantains to the ermbarcudero, was the consummation of all his wishes.

After a long discourse on the emptiness of human greatness, he drew from a leathern pouch a few very small opaque pearls, which he forced us to accept, enjoining us at the same time to note on our tablets that a poor shoemaker of Araya, bat a white man, and of noble Castilian race, had been enabled to give us something which, on the other side of the sea," was sought for as very precious. I here acquit myself of the promise I made to this worthy man, who disinterestedly refused to accept of the slightest retribution. The Pearl Coast presents the same aspect of misery as the countries of gold and diamonds, Choco and Brazil; but misery is not there attended with that immoderate desire of gain which is excited by mineral wealth.

The pearl-breeding oyster (Avicula margaritifera, Cuvier) abounds on the shoals which extend from Cape Paria to Cape la Vela. The islands of Margareta, Cubagua, Coche, Punta Araya, and the mouth of the Rio la Hacha, were, in the sixteenth century, as celebrated as were the Persian Gulf and the island of Taprobana among the ancients. It is incorrectly alleged by some historians that the natives of America were unacquainted with the luxary of pearls. The first Spaniards who landed in Terra Firma found the savages decked with pearl necklaces and bracelets; and among the civilized people of Mexico and Peru, pearls of a beautiful form were extremely sought after. I have published a dissertation on the statue of a Mexican priestess in basalt, whose head-dress, resembling the calantica of the heads of Isis, is ornamented with pearls. Las Casas and Benzoni have described, but not without some exaggeration, the cruelties which were exercised on the unhappy Indian slaves and negroes emplojed in the pearl fishery. At the beginning of the conquest the island of Coche alone furnished pearls ampunting in value to fifteen hundred marks per month.

The quint which the king's officers drew from the produce of pearls, amounted to fifteen thousand ducats; which, according to the value of the precious metals in those times,

[^58]and the extensiveness of contraband trade, may be regarded as a very considerable sum. It appears that till 1530 the value of the pearls sent to Europe amounted yearly on an average to more than eight hundred thousand piastres. In order to judge of the importance of this branch of commerce to Seville, Toledo, Antwerp, and Genoa, we should recollect that at the same period the whole of the mines of America did not furnish two millions of piastres; and that the fleet of Ovando was thought to contain immense wealth, because it had on board nearly two thousand six hundred marks of silver. Pearls were the more sought after, as the luxury - of Asia had been introduced into Europe by two ways diametrically opposite: that of Constantinople, where the Palæologi wore garments covered with strings of pearls; and that of Grenada, the residence of the Moorish kings, who displayed at their court all the luxury of the East. The pearls of the East were preferred to those of the West; but the number of the latter which circulated in commerce was nevertheless considerable at the period immediately followed the discovery of America. In Italy as well as in Spain, the islet of Cubagua became the object of numerous mercantile speculations.

Benzoni* relates the adventure of one Luigi Lampagnano, to whom Charles the Fifth granted the privilege of proceeding with five carvels to the coasts of Cumana to fish for pearls. The colonists sent him back with this bold message: ""That the emperor was too liberal of what was not his own, and that he had no right to dispose of the oysters which live at the bottom of the sea."

The pearl fishery diminished rapidly about the end of the sixteenth century; and, according to Laet, it had long ceased in 1633. $\dagger$ The industry of the Venetians, who imitated fine pearls with great exactness, and the frequent use of cut

- La Hist. del Mondo Nuovo, p. 34. Luigi Lampagnano, a relation of the assassin of the Duke of Milan, Galeazzo Maria Sforza, could not pay the merchants of Seville who had advanced the money for his voyage; he remained five years at Cubagua, and died in a fit of insanity.
† "Insularum Cubaguæ et Coches quondam magna fuit dignitas, quum Unionum captura fioreret: nunc, illa deficiente, obscura admodum fama." Laet, Nova Orbis, p. 669. This accurate compiler, speaking of Punta Araya, adds, this country is so forgotten, "ut vix ulla Americæ meridionalis pars hodie obscurior sit."
diamonds,* rendered the fisheries of Cubagua less lucrative. At the same time, the oysters which yielded the pearls became scarcer, not, because, according to a popular tradition, they were frightened by the sound of the oars, and removed elsewhere; but because their propagation had been impeded by the imprudent destruction of the shells by thousands. The pearl-bearing oyster is of a more delicate nature than most of the other acephalous mollusca. At the island of Ceylon, where, in the bay of Condeatchy, the fishery emplofs six hundred divers, and where the annual produce is more than half a million of piastres, it has vainly been attempted to transplant the oysters to other parts of the coast. The government permits fishing there only during a single month; while at Cubagua the bank of shells was fished at all seasons. To form an idea of the destruction of the species caused by the divers, we must remember that a boat sometimes collects, in two or three weeks, more than thirty-five thousand oysters. The animal lives but nine or ten years; and it is only in its fourth year that the pearls begin to show themselves. In ten thousand shells there is often not a single pearl of value. Tradition records that on the bank of Margareta the fishermen opened the shells one by one: in the island of Ceylon, the animals are thrown into heaps to rot in the air; and to separate the pearls which are not attached to the shell, the animal pulp is washed, as miners wash the sand which contains grains of gold, tin, or diamonds.

At present Spanish America furnishes no other pearls for trade than those of the gulf of Panama, and the mouth of the Rio de la Hacha. On the shoals which surround Cubagua, Coche, and the island of Margareta, the fishery is as much neglected as on the coasts of California. $\dagger$ It is believed at Cumana, that the pearl-oyster has greatly multiplied after two centuries of repose; and in 1812, some new attempts were made at Margareta for the fishing of pearls. It has been asked, why the pearls found at present in shells which become entangled in the fishermen's nets are so small, and

[^59]have so little brilliancy,* whilst, on the Spaniards' arrival, they were extremely beautiful, though the Indians doubtless had not taken the trouble of diving to collect them. The problem is so much the more difficult to solve, as we know not whether earthquakes may have altered the nature of the bottom of the sea, or whether the changes of the submarine currents may have had an influence either on the temperature of the water, or on the abundance of certain mollusca on which the Aronde feeds.

On the morning of the 20th our host's son, a young and very robust Indian, conducted us by the way of Barigon and Caney to the village of Maniquarez, which was four hours' walk. From the effect of the reverberation of the sands, the thermometer kept up to $31^{\circ} 3^{\prime}$. The cylindric cactus, which bordered the road, gave the landscape an appearance of verdure, without affording either coolness or shade. Before .our guide had walked a league, he began to sit down every moment, and at length he wished to repose under the shade of a fine tamarind tree near Casas de la Vela, to await the approach of night. This characteristic trait, which we observed every time we travelled with Indians, has given rise to very erroneous ideas of the physical constitutions of the different races of men. The copper-coloured native, more accustomed to the buming heat of the climate, than the European traveller, complains more, because he is stimulated by no interest. Money is without attraction for him; and if he permits himself to be tempted by gain for a moment, he repents of his resolution as soon as he is on the road. The same Indian, who would complain, when in herborizing we loaded him with a box filled with plants, would row his canoe fourteen or fifteen hours together, against the strongest current, because he wished to return to his family. In order to form a true judgment of the muscular strengh of the people, we should observe them in circumstances where their actions are determined by a necessity and a will equally energetic.

We examined the ruins of Santiago, $\dagger$ the structure of

[^60]which is remarkable for its extreme solidity. The walls of freestone, five feet thick, have been blown up by mines; but we still foumd masses of seven or eight handred feet square, which have scarcely a crack in them. Our guide showed us a cistern (aljibe) thirty feet deep, which, though much damaged, furnishes water to the imhabitants of the peninsula of Araya. This cistern was finished in 1681, by the governor Don Juan de Padilla Guardiola, the same who built at Cumana the small fort of Santa Maria. As the basin is covered with an arched vaalt, the water, which is of excellent quality, keeps very cool : the confervæ, while they decompose the carburetted hydrogen, also shelter worms which hinder the propagation of small insects. It had been bekieved for ages, that the peninsula of Araya was entirely destitute of springs of fresh water; but in 1797, after many useless researches, the inhabitants of Maniquarez succeeded in discovering some.

In erossing the arid hills of Cape Cirial, we perceived a strong smell of petroleum. The wind blew from the direction in which the springs of this substance are found, and which were mentioned by the first historians of these countries.* Near the village of Maniquarez, the mica-slate $\dagger$ comes out from below the secondary rock, forming a chain of mountains from one hundred and fifty to one hundred and eighty toises in height. The direction of the primitive rock near Cape Sotto is from north-east to south-west; its strata incline fifty degrees to the north-west. The mica-slate is silvery white, of lamellar and undulated texture, and contains garnets. Strata of quartz, the thickness of which varies from three to four toises, traverse the mica-slate, as we may observe in several ravines hollowed out by the waters. We detached with difficulty a fragment of cyanite from a block of splintered and milky quartz, which was isolated on the shore. This was the only time we found this substance in South America. $\ddagger$

This latter denomination was formerly synonymous with Cumana.Herrera, p. 14.

* Oviedo, terms it "A resinous, aromatic, and medicinal liquar."
$\dagger$ The Piedra pelada of the Creoles.
$\ddagger$ In New Spain, the cyanite has been discovered only in the province of Guatimala, at Estancia Grande,-Del Rio, Tablas Min., 1804, p. 27.

The potteries of Maniquarez, celebrated from time immemorial, form a branch of industry which is exclusively in the hands of the Indian women. The manufacture is still carried on according to the method used before the conquest. It indicates both the infancy of the art, and that unchangeability of manners which is characteristic of all the natives of America. Three centuries have been insufficient to introduce the potter's-wheel, on a coast which is not above thirty or forty days' sail from Spain. The natives have some confused notions with respect to the existence of this machine, and they would no doubt make use of it if it were introduced among them. The quarries whence they obtain the clay are half a league to the east of Maniquarez. This clay is produced by natural decomposition of a mica-slate reddened by oxide of iron. The Indian women prefer the part most abounding in mica; and with great skill fashion vessels two or three feet in diameter, giving them a very regular curve. As they are not acquainted with the use of ovens, they place twigs of desmanthus, cassia, and the arborescent capparis, around the pots, and bake them in the open air. To the east of the quarry which furnishes the clay is the ravine of La Mina. It is asserted, that, a short time after the conquest, some Venetians extracted gold from the mica-slate. It appears, that this metal was not collected in veins of quartz, but was found disseminated in the rock, as it is sometimes in granite and gneiss.

At Maniquarez we met with some creoles, who had been hunting at Cubagua. Deer of a small breed are so common in this uninhabited islet, that a single individual may kill three or four in a day. I know not by what accident these animals have got thither, for Laet and other chroniclers of these countries, speaking of the foundation of New. Cadiz, mention only the great abundance of rabbits. The venado of Cubagua belongs to one of those numerous species of small American deer, which zoologists have long confounded under the vague name of Cervus mexicanus. It does not appear to be the same as the hind of the savannahs of Ca yenne, or the guazuti of Paraguay, which live also in herds. Its colour is a brownish red on the back, and white under the belly; and it is spotted like the axis. In the plains of Cari.we were shown, as a thing very rare in these hot
climates, a variety quite white. It was a female of the size of the roebuck of Europe, and of a very elegant shape. White varieties are found in the New Continent even among the tigers. Azara saw a jaguar, the skin of which was wholly white, with merely the shadow, as it might be termed, of a few circular spots.

Of all the productions on the coasts of Araya, that which the people consider as the most extraordinary, or we may say the most marvellous, is ' the stone of the eyes,' (piedra de los ojos.) This calcareous substance is a frequent subject of conversation: being, according to the natural philosophy of the natives, both a stone and an animal. It is found in the sand, where it is motionless; but if placed on a polished surface, for instance on a pewter or earthern plate, it moves when excited by lemon juice. If placed in the eye, the supposed animal turns on itself, and expels every other foreign substance that has been accidentally introduced. At the new salt-works, and at the village of Maniquarez, these stones of the eyes* were offered to us by hundreds, and the natives were anxious to show us the experiment of the lemon juice. They even wished to put sand into our eyes, in order that we might ourselves try the efficacy of the remedy. It was easy to see that the stones are thin and porous opercula, which have formed part of small univalve shells. Their diameter varies from one to four lines. One of their two surfaces is plane, and the other convex. These calcareous opercula effervesce with lemon juice, and put themselves in motion in proportion as the carbonic acid is disengaged. By the effect of a similar reaction, loaves placed in an oven move sometimes on a horizontal plane; a phenomenon that has given occasion, in Europe, to the popular prejudice of enchanted ovens. The piedras de los ojos, introduced into the eye, act like the small pearls, and different round grains employed by the American savages to increase the flowing of tears. These explanations were little to the taste of the inhabitants of Araya. Nature has the appearance of greatness to man in proportion as she is veiled in mystery; and the ignorant are prone to put faith in everything that borders on the marvellous.

* They are found in the greatest abundance near the battery at the point of Cape Araya.

Proceding along the southern coast, to the east of Maniquarez, we find running out into the sea very near each other, three strips of land, bearing the names of Punta de Soto, Punta de la Brea, and Punta Guaratarito. In these parts the bottom of the sea is evidently formed of mica-slate, and from it near Cape de la Brea, but at eighty feet distant from the shore, there issues a spring of naphtha, the smell of which penetrates into the interior of the peninsula. It is necessary to wade into the sea up to the waist, to examine this interesting phenomenon. The waters are covered with zostera; and in the midst of a very extensive bank of weeds, we distinguish a free and circular spot of three feet in diameter, on which float a few scattered masses of Ulva lactuca. 'Here the springs are found. The bottom of the gulf is covered with sand; and the petroleum, which, from its transparency and its yellow colour, resembles naphtha, rises in jets, accompanied by air bubbles. On treading down the bottom with the foot, we perceive that these little springs change their place. The naphtha covers the surface of the sea to more than a thousand feet distant. If we suppose the dip of the strata to be regular, the mica-slate must be but a few toises below the sand.

We have already observed, that the muriatiferous clay of Araya contains solid and friable petroleum. This geological connection between the muriate of soda and the bitumens is evident wherever there are mines of sal-gem or salt springs: but a very remarkable fact is the existence of a fountain of naphtha in a primitive formation. All those hitherto known belong to secondary mountains;* a circumstance which has been supposed to favour the idea that all mineral bitumens are owing to the destruction of vegetables and animals, or to the burning of coal. In the peninsula of Araya, the naphtha flows from the primitive rock itself; and this phenomenon acquires new importance, when we recollect that the same primitive rocks contain the subterranean fires, that on the brink of burning craters the smell of petroleum is perceived from time to time, and that the greater part of the hot springs of America rise from gneiss and micaceous schist.

[^61]After having examined the environs of Maniquares, we embarked at night in a fishing-boat for Cumana. The small crazy boats employed by the natives here, bear testimony to the extreme calmness of the sea in these regfons. Our boat, though the best we could procure, was so leaky, that the pilot's son was constantly employed in baling out the water with a tutuma, or shell of the Crescentia cujete (calabash). It often happens in the gulf of Cariaco, and especially to the north of the peninsula of Araya, that canoes laden with cocoa-nuts are upset in sailing too near the wind, and against the tide.

The inhabitants of Araya, whom we visited a second time on returning from the Orinoco, have not forgotten that their peninsula was one of the points first peopled by the Spaniards. They love to talk of the pearl fishery; of the rains of the castle of Santiago, which they hope to see some day rebuilt; and of everything that recalls to mind the ancient splendour of those countries. In China and Japan those inventions are considered as recent, which have not been known above two thousand years; in the European colonies an event appears extremely old, if it dates back three centuries, or about the period of the discovery of America.

Chapter VI.<br>Mountains of New Andalusia.-Valley of Cumanacoa.-Summit of the Cocollar.-Missions of the Chayma Indians.

Our first visit to the peninsula of Araya was soon succeeded by an excursion to the mountains of the missions of the Chayma Indians, where a variety of interesting objects claimed our attention. We entered on a country studded with forests, and visited a convent surrounded by palm-trees and arborescent ferns. It was situated in a narrow valley, where we felt the enjoyment of a cool and delicious climate, in the centre of the torrid zone. The surrounding mountains contain caverns haunted by thousands of nocturnal birds; and, what affects the imagination more than all the wonders of the physical world, we find beyond these mountains a people lately nomade, and still nearly in a state of nature, wild without being barbarous. It was in the promontory of Paria that Columbus first descried the continent; there terminate these valleys, laid waste alternately by the warlike anthropophagic Carib and by the commercial and polished nations of Europe. At the beginning of the sixteenth century the ill-fated Indians of the coasts of Carupano, of Macarapan, and of Caracas, were treated in the same manner as the inhabitants of the coast of Guinea in our days. The soil of the islands was cultivated, the vegetable produce of the Old World was transplanted thither, but a regular system of colonization remained long unknown on the New Continent. If the Spaniards visited its shores, it was only to procure, either by violence or exchange, slaves, pearls, grains of gold, and dye-woods; and endeavours were made to ennoble the motives of this insatiable avarice by the pretence of enthusiastic zeal in the cause of religion.

The trade in the copper-coloured Indians was accompanied by the same acts of inhumanity as that which characterizes the traffic in African negroes; it was attended also by the same result, that of rendering both the conquerors and the conquered more ferocious. Thence wars became more frequent
among the natives; prisoners were dragged from the inland countries to the coast, to be sold to the whites, who loaded them with chains in their ships. Yet the Spaniards were at that period, and long after, one of the most polished nations of Europe. The light which art and literature then shed over Italy, was reflected on every nation whose language emanated from the same source as that of Dante and Petrarch. It might have been expected that a general improvement of manners would be the natural consequence of this noble awakening of the mind, this sublime soaring of the imagination. But in distant regions, wherever the thirst of wealth has introduced the abuse of power, the nations of Europe, at every period of their history, have displayed the same character. The illustrious era of Leo $\mathbf{X}$ was signalized in the New World by acts of cruelty that seemed to belong to the most barbarous ages. We are less surprised, however, at the horrible picture presented by the conquest of America when we think of the acts that are still perpetrated on the western coast of Africa, notwithstanding the benefits of a more humane legislation.

The principles adopted by Charles V. had abolished the slave trade on the New Continent. But the Conquistadores, by the continuation of their incursions, prolonged the system of petty warfare which diminished the American population, perpetuated national animosities, and during a long period crushed the seeds of rising civilization. At length the missionaries, under the protection of the secular arm, spoke words of peace. It was the privilege of religion to console humanity for a part of the evils committed in its name; to plead the cause of the natives before kings, to resist the violence of the commendataries, and to assemble wandering tribes into small communities called Missions.

But these institutions, useful at first in stopping the effusion of blood, and in laying the first basis of society, have become in their result hostile to its progress. The effects of this insulated system have been such that the Indians have remained in a state little different from that in which they existed whilst yet their scattered dwellings were not collected round the habitation of a missionary. Their number has considerably augmented, but the sphere of their ideas is not enlarged. They have progressively lost that
vigour of character and that natural vivacity which in every state of society are the noble fruits of independence. By subjecting to invariable rules even the slightest actions of their domestic life, they have been rendered stupid by the effort to render them obedient. Their subsistence is in general more certain, and their habits more pacific, but subject to the constraint and the dull monotony of the government of the Missions, they show by their gloomy and reserved looks that they have not sacrificed their liberty to their repose without regret.

On the 4th of September, at five in the morning, we began our journey to the Missions of the Chayma Indians and the group of lofty mountains which traverse New Andalusia. On account of the extreme difficulties of the road, we had been advised to reduce our baggage to a very small bolk. Two beasts of burden were sufficient to carry our provision, our instruments, and the paper necessary to dry our plants. One chest contained a sextant, a dippingneedle, an apparatus to determine the magnetic variation, a few thermometers, and Saussure's hygrometer. The greatest changes in the pressure of the air in these climates, on the coasts, amount only to $1-1.3$ of a line ; and if at any given hour or place the height of the mercury be once marked, the variations which that height experiences throughout the whole year, at every hour of the day or night, may with some accuracy be determined.

The morning was deliciously cool. The road, or rather path, which leads to Cumanacoa, runs along the right bank of the Manzanares, passing by the hospital of the Capuchins, situated in a small wood of lignum-vitæ and arborescent capparis.* On learing Cumana we enjoyed during the short duration of the twilight, from the top of the hill of San Francisco, an extensive view over the sea, the plain covered with berat and its golden flowers, and the mountains of the Brigantine. We were $\cdot$ struck by the great proximity in

[^62]which the Cordillera appeared before the disk of the rising sun had reached the horizon. The tint of the sammits is of a deeper blue, their outline is more strongly marked, and. their masses are more detached, as long as the transparency of the air is undisturbed by the vapours, whieh, after accu-mulating during the night in the valleys, rise in proportion as the atmosphere acquires warmth.

At the hospital of the Divina Pastora the path turns to north-east, and stretches for two leagues over a soil without trees, and formerly levelled by the waters. We there found not only cactuses, tufts of cistus-leaved tribulus, and the beautiful purple euphorbia,* but also the avicennia, the allionia, the sesuvium, the thalinum, and most of the portulaceons plants which grow on the banks of the gulf of Cariaco. This geographical distribution of plants appears to designate the limits of the ancient coast, and to prove that the hills along the southern side of which we were pasning, formed heretofore a small island, separated from the continent by an arm of the sea.

After walking two hours, we arrived at the foot of the bigh chain of the interior mountains, which stretches from east to west; from the Brigantine to the Cerro de San Lorenzo. There, new rocks appear, and with them another aspect of vegetation. Every object assumes a more majestic and picturesque character; the soil, watered by springs, is furrowed in every direction; trees of gigantic height, covered with lianas, rise from the ravines; their bark, black and burnt by the double action of the light and the oxygen of the atmosphere, contrasts with the fresh verdure of the pothos and dracontium, the tough and shining leaves of which are sometimes several feet long. The parasite monocotyledons take between the tropics the place of the moss and lichens of our northern zone. As we advanced, the forms and grouping of the rocks reminded us of Switzerland and the Tyrol. The heliconia, costus, maranta, and other plants of the family of the balisiers (Canna indica), which near the coasts vegetate only in damp and low places, flourish in the American Alps at considerable height. Thus, by a singular similitude, in the torrid zone, under the influence of an atmosphere continually loaded with vapours * Euphorbia tithymaloides.
the mountain vegetation presents the same features as the vegetation of the marshes in the north of Europe on soil moistened by melting snow.*

Before we leave the plains of Cumana, and the breccia, or calcareous sandstone, which constitutes the soil of the seaside, we will describe the different strata of which this very recent formation is composed, as we observed it on the back of the hills that surround the castle of San Antonio.

The breccia, or calcareous sandstone, is a local and partial formation, peculiar to the peninsula of Araya, the coasts of Cumana, and Caracas. We again found it at Cabo Blanco, to the west of the port of Guayra, where it contains, besides broken shells and madrepores, fragments, often angular, of quartz and gneiss. This circumstance assimilates the breccia to that recent sandstone called by the German mineralogists nagelfuhe, which covers so great a part of Switzerland to the height of a thousand toises, without presenting any trace of marine productions. Near Cumana the formation of the calcareous breccia contains:-1st, a compact whitish grey limestone, the strata of which, sometimes horizontal, sometimes irregularly inclined, are from five to six inches thick; some beds are almost unmixed with petrifactions, but in the greatest part the cardites, the turbinites, the ostracites, and shells of small dimension, are found so closely connected, that the calcareous matter forms only a cement, by which the grains of quartz and the organized bodies are united: 2dly, a calcareous sandstone, in which the grains of sand are much more frequent than the petrified shells; other strata form a sandstone entirely free from organic fragments, yielding but a small effervescence with acids, and enclosing not lamella of mica, but nodules of compact brown iron-ore: Sd, beds of indurated clay containing selenite and lamellar gypsum.

The breccia, or agglomerate of the sea-coast, just described, has a white tint, and it lies immediately on the calcareous formation of Cumanacoa, which is of a bluish grey. These two rocks form a contrast no less striking than the molasse (bur-stone) of the Pays de Vaud, with the calcareous limestone of the Jura. It must be observed, that, by contact of

* Wahlenberg, de Vegetation Helvetix, et summi Septentrionis, pp. 47, 59.
the two formations lying upon each other, the beds of the limestone of Cumanacoa, which I consider as an Alpine limestone, are always largely mixed with clay and marl. Lying, like the mica-slate of Araya, north-east and southwest, they are inclined, near Punta Delgada, under an angle of 60 degrees to south-east.

We traversed the forest by a narrow path, along a rivulet, which rolls foaming over a bed of rocks. - We observed, that the vegetation was more brilliant, wherever the Alpine limestone was covered by a quartzose sandstone without petrifactions, and very different from the breccia of the sea-coast. The cause of this phenomenon depends probably not so much on the nature of the ground, as on the greater humidity of the soil. The quartzose sandstone contains thin strata of a blackish clay-slate,* which might easily be confounded with the secondary thonschiefer; and these strata hinder the water from filtering into the crevices, of which the Alpine limestone is full. This last offers to view here, as in Saltzburg, and on the chain of the Apennines, broken and steep beds. The sandstone, on the contrary, wherever it is seated on the calcareous rock, renders the aspect of the scene less wild. The hills which it forms appear more rounded, and the gentler slopes are covered with a thicker mould.

In humid places, where the sandstone envelopes the Alpine limestone, some trace of cultivation is constantly found. We met with huts inhabited by mestizoes in the ravine of Los Frailes, as well as between the Cuesta de Caneyes, and the Rio Guriental. Each of these huts stands in the centre of an enclosure, containing plantains, papaw-trees, sugarcanes, and maize. We might be surprised at the small extent of these cultivated spots, if we did not recollect that an acre planted with plantains $\dagger$ produces nearly twenty times as much food as the some space sown with corn. In Europe, our wheat, barley, and rye cover vast spaces of ground; and in general the arable lands touch each other, wherever the inhabitants live upon corn. It is different under the torrid zone, where man obtains food from plants which yield more abundant and earlier harvests. In those favoured climes, the fertility of the soil is proportioned to the heat and humidity of the atmosphere. An immense population finds
abundant nourishment within a narrow space, covered with plantains, cassava, yams, and maize. The isolated situation of the huts dispersed through the forest indicates to the traveller the fecundity of nature, where a small spot of culrated land suffices for the wants of several families.

These considerations on the agriculture of the torrid zone involuntarily remind us of the intimate connexion existing between the extent of land cleared, and the progress of society. The richness of the soil, and the vigour of organic life, by multiplying the means of subsistence, retard the progress of nations in the paths of civilization. Under so mild and uniform a climate, the only urgent want of man is that of food. This want only, excites him to labour ; and we may easily conceive why, in the midst of abundance, beneath the shade of the plantain and bread-fruit tree, the intellectual faculties unfold themselves less rapidly than under a rigourous sky, in the region of corn, where our race is engaged in a perpetual struggle with the elements. In Europe we estimate the number of the inhabitants of a country by the extent of caltivation : within the tropics, on the contrary, in the warmest and most humid parts of South America, very populous provinces appear almost deserted; because man, to find nourishment, cultivates but a small number of acres. These circumstances modify the physical appearance of the country and the character of its inhabitants, giving to both a peculiar physiognomy; the wild and uncultivated stamp which belongs to nature, ere its primitive type has been altered by art. Without neighbours, almost unconnected with the rest of mankind, each family of settlers forms a separate tribe. This insulated state arrests or retards the progress of civilization, which advances only in proportion as society becomes numerous, and its connexions more intimate and multiplied. But, on the other hand, it is solitude that developes and strengthens in man the sentiment of liberty and independence; and gives birth to that noble pride of character which has at all times distinguished the Castilian race.

From these causes, the land in the most populous regions of equinoctial America still retains a wild aspeet, which is destroyed in temperate climates by the cultivation of corn. Within the tropics the agricultural nations occupy less
ground: man has there less extended his empire; he may be said to appear, not as an absolute master, who changes at will the surface of the soil, but as a transient guest, who quietly enjoys the gifts of nature. There, in the neighbourhood of the most populous cities, the land remains studded with forests, or covered with a thick mould, unfurrowed by the plough. Spontaneous vegetation still predominates over cultivated plants, and determines the aspect of the landscape. It is probable that this state of things will change very slowly. If in our temperate regions the cultivation of corn contributes to throw a dull uniformity upon the land we have cleared, we cannot doubt, that, even with increasing population, the torrid zone will preserve that majesty of vegetable forms, those marks of an unsubdued, virgin nature, which render it so attractive and so picturesque. Thus it is that, by a remarkable concatenation of physical and moral causes, the choice and production of alimentary plants have an influence on three important objects at once; the association or the isolated state of families, the more or less rapid progress of civilization, and the individual character of the landscape.
: In proportion as we penetrated into the forest, the barometer indicated the progressive elevation of the land. The trunks of the trees presented here an extraordinary phenomenon; a gramineous plant, with verticillate branches,* climbs, like a liana, eight or ten feet high, and forms festoons, which cross the path, and swing about with the wind. We halted, about three o'clock in the afternoon, on a small flat, known by the name of Quetepe, and situated about one hundred and ninety toises above the level of the sea. A few small houses have been erected near a spring, well known by the natives for its coolness and great salubrity. We found the water. delicious. Its temperature was only $22.5^{\circ}$ of the centigrade thermometer, while that of the air was $28.7^{\circ}$. The springs which descend from the neighbouring mountains of a greater height often indicate a too rapid decrement of heat. If indeed we suppose the mean temperature of the water on the coast of Cumana equal to $26^{\circ}$, we must conclude, unless other local causes modify the temperature of the

- Carice, analogous to the chusque of Santa Fé, of the group of the Nastuses. This gramineous plant is excellent pasture for mules.
springs, that the spring of Quetepe acquires its great coolness at more than 350 toises of absolute elevation. With respect to the springs which gush out in the plains of the torrid zone, or at a small elevation, it may be observed, in general, that it is only in regions where the mean temperature of summer essentially differs from that of the whole year, that the inhabitants have extremely cold spring water during the season of great heat. The Laplanders, near Umea and Sœrsele, in the 65th degree of latitude, drink spring-water, the temperature of which, in the month of August, is scarcely two or three degrees above freezing point; while during the day the heat of the air rises in the shade, in the same northern regions, to 26 or 27 degrees. In the temperate climates of France and Germany, the difference between the air and the springs never exceeds 16 or 17 degrees; between the tropics it seldom rises to 5 or 6 degrees. It is easy to account for these phenomena, when we recollect that the interior of the globe, and the subterraneous waters, have a temperature almost identical with the annual mean temperature of the air; and that the latter differs from the mean heat of summer, in proportion to the distance from the equator.

From the top of a hill of sandstone, which overlooks the spring of Quetepe, we had a magnificent view of the sea, of cape Macanao, and the peninsula of Maniquarez. At our feet an immense forest extended to the edge of the ocean. The tops of the trees, intertwined with lianas, and crowned with long wreaths of flowers, formed a vast carpet of verdure, the dark tint of which augmented the splendour of the aerial light. This picture struck us the more forcibly, as we then first beheld those great masses of tropical vegitation. On the hill of Quetepe, at the foot of the Malpighia cocollobæfolia, the leaves of which are extremely coriaceous, we gathered, among tufts of the Polygala montana, the first melastomas, especially that beautiful species described under the name of the Melastoma rufescens.

As we advanced toward the south-west, the soil became dry and sandy. We climed a group of mountains, which separate the coast from the vast plains, or savannahs, bordered by the Orinoco. That part of the group, over which passes the road to Cumanacoa, is destitute of vegetation, and has steep declivities both on the north and the south.

It has received the name of the Imposible, because it is believed that, in the case of hostile invasion, this ridge of mountains would be inaccessible to the enemy, and would offer an asylum to the inhabitants of Cumana. We reached the top a little before sunset, and I had scarcely time to take a few horary angles, to determine the longitude of the place by means of the chronometer.

The view from the Imposible is finer and more extensive than that from the table-land of Quetepe. We distinguished clearly by the naked eye the flattened top of the Brigantine (the position of which it would be important to fix accurately), the embarcadero or landing-place, and the roadstead of Cumana. The rocky coast of the peninsula of Araya was discernible in its whole length. We were particularly struck with the extraordinary configuration of a port, known by the name of Laguna Grande, or Laguna del Obispo. A vast basin, surrounded by high mountains, communicates with the gulf of Cariaco by a narrow channel which admits only of the passage of one ship at a time. This port is capable of containing several squadrons at once. It is an uninhabited place, but annually frequented by ressels, which carry mules to the West India Islands. There are some pasture grounds at the farther end of the bay. We traced the sinuosities of this arm of the sea, which, like a river, has dug a bed between perpendicular rocks destitute of vegetation. This singular prospect reminded us of the fanciful landscape which Leonardo da Vinci has made the back-ground of his famous portrait of Mona Lisa, the wife of Francisco del Giacondo.

We could observe by the chronometer the moment when the disk of the sun touched the horizon of the sea. The first contact was at $6^{\text {h }} 8^{\prime} 13^{\prime \prime}$; the second, at $6^{\text {h }} 10^{\prime} 26^{\prime \prime}$, mean time. This observation, which is not unimportant for the theory of terrestrial refractions, was made on the summit of the mountain, at the absolute height of 296 toises. The setting of the sun was attended by a very rapid cooling of the air. Three minutes" after the last apparent contact of the disk with the horizon of the sea, the thermometer suddenly fell from $25.2^{\circ}$ to $21 \cdot 3^{\circ}$. Was this extraordinary refrigeration owing to some descending current? The air was however calm, and no horizontal wind was felt.

We passed the night in a house where there was a military vol. I.
post consisting of eight men, under the command of a Spanish serjeant. It was an hospital, built by the side of a powdermagazine. When Cumana, after the capture of Trinidad by the English, in 1797, was threatened with an attack, many of the inhabitants fled to Cumanacoa, and deposited whatever articles of value they possessed in sheds hastily constructed on the top of the Imposible. It was then resolved, in case of any unforeseen invasion, to abandon the castle of San Antonio, after a short resistance, and to concentrate the whole force of the province round the mountains, which may be considered as the key of the Llanos.

The top of the Imposible, as nearly as I could perceive, is covered with a quartzose sandstone, free from petrifactions. Here, as on the ridge of the neighbouring mountains, the strata pretty regularly take the direction from N. N. E. to S. S. W. This direction is also most common in the primitive formations in the peninsula of Araya, and along the coasts of Venezuela. On the northern declivity of the Imposible, near the Peñas Negras, an abundant spring issues from sandstone, which alternates with a schistose clay. We remarked on this point fractured strata, which lie from N.W. to S. E., and the dip of which is almost perpendicular.

The Llaneros, or inhabitants of the plains, send their produce, especially maize, leather, and cattle, to the port of Cumana by the road over the Imposible. We continually saw mules arrive, driven by Indians or mulattoes. Several parts of the vast forests which surround the mountain, had taken fire. Reddish flames, half enveloped in clouds of smoke, presented a very grand spectacle. The inhabitants set fire to the forests, to improve the pasturage, and to destroy the shrubs that choke the grass. Enormous conflagrations, too, are often caused by the carelessness of the Indians, who neglect, when they travel, to extinguish the fires by which they have dressed their food. These accidents contribute to diminish the number of old trees in the road from Cumana to Cumanacoa; and the inhabitants observe justly, that, in several parts of their province, the dryness has increased, not only because every year the frequency of earthquakes causes more crevices in the soil; but also because it is now less thickly wooded than it was at the time of the conquest.

I arose during the night to determine the latitude of the

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place by the passage of Fomalhaut over the meridian; but the observation was lost, owing to the time I employed in taking the level of the artificial horizon. It was midnight, and I was benumbed with cold, as were also our guides : yet the thermometer kept at $19 \cdot 7^{\circ}$. At Cumana I have never seen it sink below $21^{\circ}$; but then the house in which we dwelt on the Imposible was 258 toises above the level of the sea. At the Casa de la Polvora I determined the dip of the magnetic needle, which was $42 \cdot 5^{\circ}$.* The number of oscillations correspondent to $10^{\prime}$ of time was 233 . The intensity of the magnetic forces had consequently augmented from the coast to the mountain, perhaps from the influence of some ferruginous matter, hidden in the strata of sandstone which cover the Alpine limestone.

We left the Imposible on the 5th of September before sunrise. The descent is very dangerous for beasts of burden; the path being in general but fifteen inches broad, and bordered by precipices. In descending the mountain, we observed the rock of Alpine limestone reappearing under the sandstone. The strata being generally inclined to the south and south-east, a great number of springs gush out on the southern side of the mountain. In the rainy season of the year, these springs form torrents, which descend in cascades, shaded by the hura, the cuspa, and the silver-leaved cecropia or trumpet-tree.

The cuspa, a very common tree in the environs of Cumana and of Bordones, is yet unknown to the botanists of Europe. It was long used only for the building of houses, and has become celebrated since 1797, under the name of the cascarilla or bark-tree (cinchona) of New Andalusia. Its trunk rises scarcely above fifteen or twenty feet. Its alternate leaves are smooth, entire, and oval. $\dagger$ Its bark very thin, and of a pale yellow, is a powerful febrifuge. It is even more bitter than the bark of the real cinchona, but is less disagreeable. The cuspa is administered with the greatest saccess, in a spirituous tincture, and in aqueous infusion, both in intermittent and in malignant fevers.

[^63]On the coasts of New Andalusia, the cuspa is considered as a kind of cinchona; and we were assured, that some Aragonese monks, who had long resided in the kingdom of New Grenada, recognised this tree from the resemblance of its leaves to those of the real Peruvian-bark tree. This, however, is unfounded; since it is precisely by the disposition of the leaves, and the absence of stipules, that the cuspa differs totally from the trees of the rubiaceous family. It may be said to resemble the family of the honeysuckle, or caprifoliaceous plants, one section of which has alternate leaves, and among which we find several corneltrees, remarkable for their febrifuge properties.*

The taste, at once bitter and astringent, and the yellow colour of the bark led to the discovery of the febrifugal virtue of the cuspa. As it blossoms at the end of November, we did not see it in flower, and we know not to what genus it belongs; and I have in vain for several years past applied to our friends at Cumana for specimens of the flower and fruit. I hope that the botanical determination of the barktree of New Andalusia will one day fix the attention of travellers, who visit this region after us; and that they will not confound, notwithstanding the analogy of the names, the cuspa with the cuspare. The latter not only vegetates in the missions of the Rio Carony, but also to the west of Cumana, in the gulf of Santa Fé. It furnishes the druggists of Europe with the famous Cortex Angosturm, and forms the genus Bonplandia, described by M. Willdenouw in the Memoirs of the Academy of Berlin, from notes communicated to him by us.

It is singular that, during our long abode on the coast of Cumana and the Caracas, on the banks of the Apure, the Orinoco, and the Rio Negro, in an extent of country comprising forty thousand square leagues, we never met with one of those numerous species of cinchona, or exostema, which are peculiar to the low and warm regions of the tropics, especially to the archipelago of the West India Islands. Yet we are far from affirming, that, throughout the whole of the eastern part of South America, from Porto Bello to Cayenne,

[^64]or from the equator to the 10th degree of north iatitude between the meridians of 54 and 71 degrees, the cinchona absolutely does not exist. How can we be expected to know completely the flora of so vast an extent of country? But, when we recollect, that even in Mexico no species of the genera cinchona and exostema has been discovered, either in the central table-land or in the plains, we are led to believe, that the mountainous islands of the West Indies and the Cordillera of the Andes have peculiar floras; and that they possess particular species of vegetation, which have neither passed from the islands to the continent, nor from South America to the coasts of New Spain.

It may be observed farther, that, when we reflect on the numerous analogies which exist between the properties of plants and their external forms, we are surprised to find qualities eminently febrifuge in the bark of trees belonging to different genera, and even different families.* Some of

[^65]these barks so much resemble each other, that it is not easy to distinguish them at first sight. But before we examine the question, whether we shall one day discover, in the real cinchona, in the cuspa of Cumana, the Cortex Angosturx, the Indian swietenia, the willows of Europe, the berries of the coffee-tree and uvaria, a matter uniformly diffused, and exhibiting (like starch, caoutchouc, and camphor) the same chemical properties in different plants, we may ask whether, in the present state of physiology and medicine, a febrifuge principle ought to be admitted. Is it not probable, that the particular derangement in the organization, known under the vague name of the febrile state, and in which both the vascular and the nervous systems are at the same time attacked, yields to remedies which do not operate by the same principle, by the same mode of action on the same organs, by the same play of chemical and electrical attractions? We shall here confine ourselves to this observation, that, in the species of the genus cinchona, the antifebrile virtues do not appear to belong to the tannin (which is only accidentally mingled in them), or to the cinchonate of lime; but in a resiniform matter, soluble both by alcohol and by water, and which, it is believed, is composed of two principles, the cinchonic bitter and the cinchonic red.* May it then be admitted, that this resiniform matter, which possesses different degrees of energy according to the combinations by which it is modified, is found in all febrifuge substances? Those by which the sulphate of iron is precipitated of a green colour, like the real cinchona, the bark of the white willow, and the horned perisperm of the coffee-tree, do not on this account denote identity of chemical composition; $\dagger$ and that identity might even exist, without our concluding that the medical virtues were analogous. We see that

[^66]specimens of sugar and tannin extracted from plants, not of the same family, present numerous differences: while the comparative analysis of sugar, gum, and starch; the discovery of the radical of the prussic acid (the effects of which are so powerful on the organization), and many other phenomena of vegetable chemistry, clearly prove that substances composed of identical elements, few in number and propartional in quantity, exhibit the most heterogeneous properties, on account of that particular mode of combination which corpuscular chemistry calls the arrangement of the particles.

Leaving the ravine which descends from the Imposible, we entered a thick forest traversed by many small rivers, which are easily forded. We observed that the cecropia, which in the disposition of its branches and its slender trunk, resembles the palm-tree, is covered with leaves more or less silvery, in proportion as the soil is dry or moist. We saw some small plants of the cecropia, the leaves of which were on both sides entirely green.* The roots of these trees are hid under tufts of dorstenia, which flourishes only in humid and shady places. In the midst of the forest, on the banks of the Rio Cedeno, as well as on the southern declivity of the Cocollar, we find, in their wild state, papaw and orangetrees, bearing large and sweet fruit. These are probably the remains of some conucos, or Indian plantations; for in those countries the orange-tree cannot be counted among the indigenous plants, any more than the banana-tree, the papawtree, maize, cassava, and many other useful plants, with the true country of which we are unacquainted, though they have accompanied man in his migrations from the remotest times.

When a traveller newly arrived from Europe penetrates for the first time into the forests of South America, he bescarcely any febrifuge quality, yields a green precipitate like the real cinchonas. Notwithstanding the extreme imperfection of vegetable chemistry, the experiments already made on cinchonas sufficiently show, that to judge of the febrifuge virtues of a bark, we must not attach too much importance either to the principle which turns to green the oxides of iron, or to the tannin, or to the matter which precipitates infusions of tan.

* Is not the Cecropia concolor of Willdenouw a variety of the Cecropia peltata?
holds nature under an unexpected aspect. He feels at every step, that he is not on the confines but in the centre of the torrid zone ; not in one of the West India Islands, but on a vast continent where everything is gigantic,-mountains, rivers, and the mass of vegetation. If he feel strongly the beauty of picturesque scenery he can scarcely define the various emotions which crowd upon his mind; he can scarcely distinguish what most excites his admiration, the -deep silence of those solitudes, the individual beauty and contrast of forms, or that vigour and freshness of vegetable life which characterize the climate of the tropics. It might be said that the earth, overloaded with plants, does not allow them space enough to unfold themselves. The trunks of the trees are everywhere concealed under a thick carpet of verdure; and if we carefully transplanted the orchideæ, the pipers, and the pothoses, nourished by a single courbaril, or American fig-tree,* we should cover a vast extent of ground. By this singular assemblage, the forests, as well as the flanks of the rocks and mountains, enlarge the domains of organic nature. The same lianas which creep on the ground, reach the tops of the trees, and pass from one to another at the height of more than a hundred feet. Thus, by the continual interlacing of parasite plants, the botanist is often led to confound one with another, the flowers, the fruits, and leaves, which belong to different species.

We walked for some hours under the shade of these arcades, which scarcely admit a glimpse of the sky; the latter appeared to me of an indigo blue, the deeper in shade because the green of the equinoctial plants is generally of a stronger hue, with somewhat of a brownish tint. A great fern tree, $\dagger$ very different from the Polypodium arboreum of the West Indies, rose above masses of scattered rocks. In -this place we were struck for the first time with the sight of those nests in the shape of bottles, or small bags, which are suspended from the branches of the lowest trees, and which attest the wonderful industry of the orioles, which mingle their warbling with the hoarse cries of the parrots and the macaws. These last, so well known for their vivid colours, fly only in pairs, while the real parrots wander about in flocks of several hundreds. A man must have lived in those

* Ficus nympheifolia. $\dagger$ Possibly our Aspidium caducum.

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regions, particularly in the hot valleys of the Andes, to conceive how these birds sometimes drown with their voices the noise of the torrents, which dash down from rock to rock.

We left the forests, at the distance of somewhat more than a league from the village of San Fernando. A narrow path led, after many windings, into an open but extremely humid country. In such a site in the temperate zone, the cyperaceous and gramineous plants would have formed vast meadows; here the soil abounded in aquatic plants, with sagittate leaves, and especially in basil plants, among which we noticed the fine flowers of the costus, the thalia, and the heliconia. These succulent plants are from eight to ten feet - high, and in Europe one of their groups would be considered as a little wood.

Near San Fernando the evaporation caused by the action of the sun was so great that, being very lightly clothed, we felt ourselves as wet as in a vapour bath. The road was bordered with a kind of bamboo,* which the Indians call iagua, or guadua, and which is more than forty feet in height. Nothing can exceed the elegance of this arborescent gramen. The form and disposition of its leaves give it a character of lightness which contrasts agreeably with its height. The smooth and glossy trunk of the iagua generally bends towards the banks of rivulets, and it waves with the slightest breath of air. The highest reedst in the south of Europe, can give no idea of the aspect of the arborescent gramina. The bamboo and fern-tree are, of all the vegetable forms between the tropics, those which make the most powerful impression on the imagination of the traveller. Bamboos are less common in South America than is usually believed. They are almost wanting in the marshes and in the vast inundated plains of the Lower Orinoco, the Apure, and the Atabapo, while they form thick woods, several leagues in length, in the north-west, in New Grenada, and in the kingdom of Quito. It might be said that the western declivity of the Andes is their true country; and, what is remarkable enough, we found them not only in the low regions at the level of the ocean, but also in the lofty valleys of the Cordilleras, at the height of 860 toises.

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The road skirted with the bamboos above mentioned led us to the small village of San Fernando, situated in a narrow plain, surrounded by very steep calcareous rocks. This was the first Mission* we saw in America. The houses, or rather the huts of the Chayma Indians, though separate from each other, are not surrounded by gardens. The streets, which are wide and very strait, cross each other at right angles. The walls of the huts are made of clay, strengthened by lianas. The uniformity of these huts, the grave and taciturn air of their inhabitants, and the extreme neatness of the dwellings, reminded us of the establishments of the Moravian Brethren. Besides their own gardens, every Indian family helps to cultivate the garden of the community, or, as it is called, the conuco de la comunidad, which is situated at some distance from the village. In this conuco the adults of each sex work one hour in the morning and one in the evening. In the missions nearest the coast the garden of the community is generally a sugar or indigo plantation, under the direction of the missionary; and its produce, if the law were strictly observed, could be employed only for the support of the church and the purchase of sacerdotal ornaments. The great square of San Fernando, in the centre of the village, contains the church, the dwelling of the missionary, and a very humble-looking edifice pompously called the king's house (Casa del Rey). This is a caravanserai, destined for lodging travellers; and, as we often experienced, infinitely valuable in a country where the name of an inn is still unknown. The Casas del Rey are to be found in all the Spanish colonies, and may be deemed an imitation of the tambos of Peru, which were established in conformity with the laws of Manco Capac.

We had been recommended to the friars who govern the Missions of the Chayma Indians, by their syndic, who resides at Cumana. This recommendation was the more useful to us, as the missionaries, either from zeal for the purity of the

[^68]morals of their parishioners, or to conceal the monastic system from the indiscreet curiosity of strangers, often adhere with rigour to an old regulation, by which a white man of the secular state is not permitted to sojourn more than one night in an Indian village. The Missions form (I will not say according to their primitive and canonical institutions, but in reality) a distinct and nearly independent hieranchy, the views of which seldom accord with those of the secular clergy.

The missionary of San Fernando was a Capuchin, a native of Aragon, far advanced in years, but strong and healthy. His extreme corpulency, his hilarity, the interest he took in battles and sieges, ill accorded with the ideas we form in northern countries of the melancholy reveries and the contemplative life of missionaries. Though extremely busy about a cow which was to be killed next day, the old monk received us with kindness, and permitted us to hang up our hammocks in a gallery of his house. Seated, without doing anything, the greater part of the day, in an armchair of red wood, he bitterly complained of what he called the indolence and ignorance of his countrymen. Our missionary, however, seemed well satisfied with his situation. He treated the Indians with mildness; he beheld his Mission prosper, and he praised with enthusiasm the waters, the bananas, and the dairy-produce of the district. The sight of our instruments, our books, and our dried plants, drew from him a sarcastic smile; and he acknowledged, with the naïveté peculiar to the inhabitants of those countries, that of all the enjoyments of life, without excepting sleep, none was comparable to the pleasure of eating good beef (carne de vaca): thus does sensuality obtain an ascendancy, where there is no occupation for the mind.

The mission of San Fernando was founded about the end of the 17 th century, near the junction of the small rivers of the Manzanares and Lucasperez. A fire, which consumed the church and the huts of the Indians, induced the Capuchins to build the village in its present fine situation. The number of families is increased to one hundred, and the missionary observed to us, that the custom of marrying at thirteen or fourteen years of age contributes greatly to this rapid increase of population. He denied that old age was
so premature among the Chaymas, as is commonly believed in Europe. The government of these Indian parishes is very complicated; they have their governor, their majoralguazils, and their militia-commanders, all copper-coloured natives. The company of archers have their colours, and perform their exercise with the bow and arrow, in shooting at a mark; this is the national guard (militia) of the country. This military establishment, under a purely monastic system, seemed to us very singular.

On the night of the 5th of September, and the following morning, there was a thick fog; yet we were not more than a hundred toises above the level of the sea. I determined geometrically, at the moment of our departure, the height of the great calcareous mountain which rises at 800 toises distance to the south of San Fernando, and forms a perpendicular cliff on the north side. It is only 215 toises higher than the great square; but naked masses of rock, which here exhibit themselves in the midst of a thick vegetation, give it a very majestic aspect.

The road from San Fernando to Cumana passes amidst small plantations, through an open and humid valley. We forded a number of rivulets. In the shade the thermometer did not rise above $30^{\circ}$ : but we were exposed to the direct rays of the sun, because the bamboos, which skirted the road, afforded but small shelter, and we suffered greatly from the heat. We passed through the village of Arenas, inhabited by Indians, of the same race as those at San Fernando. But Arenas is no longer a mission; and the natives, governed by a regular priest,* are better clothed, and more civilized. Their church is also distinguished in the country by some rude paintings which adorn its walls. A narrow border encloses figures of armadilloes, caymans, jaguars, and other animals peculiar to the new world.

In this village lives a labourer, Francisco Lozano, who presented a highly curious physiological phenomenon. This man has suckled a child with his own milk. The mother having fallen sick, the father, to quiet the infant, took it into his bed, and pressed it to his bosom. Lozano, then thirtytwo years of age, had never before remarked that he
*The four villages of Arenas, Macarapana, Mariguitar, and Aricagua, founded by Aragonese Capuchins, are called Doctrinas de Encomienda.
had milk: but the irritation of the nipple, sucked by the child, caused the accumulation of that liquid. The milk was thick and very sweet. The father, astonished at the increased size of his breast, suckled his child two or three times a day during five months. He drew on himself the attention of his neighbours, but he never thought, as he probably would have done in Europe, of deriving any advantage from the curiosity he excited. We saw the certificate, which had been drawn up on the spot, to attest this remarkable fact, eye-witnesses of which are still living. They assured us that, during this suckling, the child had no other nourishment than the milk of his father. Lozano, who was not at Arenas during our journey in the missions, came to us at Cumana. He was accompanied by his son, then thirteen or fourteen years of age. M. Bonpland examined with attention the father's breasts, and found them wrinkled like those of a woman who has given suck. He observed that the left breast in particular was much enlarged; which Lozano explained to us from the circumstance, that the two breasts did not furnish milk in the same abundance. Don Vicente Emparan, governor of the province, sent a circumstantial account of this phenomenon to Cadiz.

It is not a very uncommon circumstance, to find, among animals, males whose breasts contain milk; and climate does not appear to exercise any marked influence on the greater or less abundance of this secretion. The ancients cite the milk of the he-goats of Lemnos and Corsica. In our own time, we have seen in Hanover, a he-goat, which for a great number of years was milked every other day, and yielded more milk than a female goat. Among the signs of the alleged weakness of the Americans, travellers have mentioned the milk contained in the breasts of men. It is, however, improbable, that it has ever been observed in a whole tribe, in some part of America unknown to modern travellers; and I can affirm that at present it is not more common in the new continent, than in the old. The labourer of Arenas, whose case has just been mentioned, was not of the copper-coloured race of Chayma Indians, but was a white man, descended from Europeans. Moreover, the anatomists of St. Petersburgh have observed that, among the lower orders of the people in Russia, milk in the breasts of
men is much more frequent than among the more southern nations : yet the Russians have never been deemed weak and effeminate. There is among the varieties of the human species a race of men whose breasts at the age of puberty acquure a considerable bulk. Lozano did not belong to that race ; and he often repeated to us his conviction, that it was only the irritation of the nipple, in consequence of the suction, which caused the flow of milk.

When we reflect on the whole of the vital phenomena, we find that no one of them is entirely isolated. In every age examples are cited of very young girls and women in extreme old age, who have suckled children. Among men these examples are more rare; and after numerous researches, I have not found above two or three. One is cited by the anatomist of Verona, Alexander Benedictus, who lived about the end of the fifteenth century. He relates the history of an inhabitant of Syria, who, to calm the fretfulness of his child, after the death of the mother, pressed it to his bosom. The milk sonn became so abundant, that the father could take on himself the nourishment of his child without assistance. Other examples are related by Santorellus, Faria, and Robert, bishop of Cork. The greater part of these phenomena having been noticed in times very remote, it is not uninteresting to physiology, that we can confirm them in our own days.

On approaching the town of Cumanacoa we found a more level soil, and a valley enlarging itself progressively. This small town is situated in a naked plain, almost circular, and surrounded by lofty mountains. It was fousded in 1717 by Domingo Arias, on the return of an expedition to the mouth of the Guarapiche, undertaken with the view of destroying an establishment which some French freebooters had attempted to found. The new town was first called San Baltazar de las Arias; but the Indian name Cumanacoa prevailed; in like manner the name of Santiago de Leon, still to be found in our maps, is forgotten in that of Caracas.

On opening the barometer we were struck'at seeing the column of mercury scarcely 7.3 lines shorter than on the coasts. The plain, or rather the table-land, on which the town of Cumanacoa is situated, is not more than 104 toises above the level of the sea, which is three or four times less
than is supposed by the inhabitants of Cumana, on account of their exaggerated ideas of the cold of Cumanacoa. But. the difference of climate observable between places so near each other is perhaps less owing to comparative height than to local circumstances. Among these causes we may cite the proximity of the forests; the frequency of descending currents, so common in these valleys, closed on every side ; the abundance of rain; and those thick fogs which diminish during a great part of the year the direct action of the solar rays. The decrement of the heat being nearly the same within the tropics, and during the summer under the temperate zone, the small difference of level of one hundred toises should produce only a change in the mean temperature of $1^{\circ}$ or $1.5^{\circ} .{ }^{\circ}$ But we shall soon find that at Cumanacoa the difference rises to more than four degrees. This coolness of the climate is sometimes the more surprising, as very great heat is felt at Carthago (in the province of Popayan) ; at Tomependa, on the bank of the river Amazon, and in the valleys of Aragua, to the west of Caracas; though the absolute height of these different places is between 200 and 480 toises. In plains as well as on mountains the isothermal lines (lines of similar heat) are not constantly parallel to the equator, or the surface of the globe. It is the grand problem of meteorology to determine the inflections of these lines, and to discover, amid modifications produced by local causes, the constant laws of the distribution of heat.

The port of Cumana is only seven nautical leagues from Cumanacoa. It scarcely ever rains in the first-mentioned place, while in the latter there are seven months of wintry weather. At Cumanacoa, the dry season begins at the winter solstice, and lasts till the vernal equinox. Light showers are frequent in the months of April, May, and June. The dry weather then returns again, and lasts from the summer solstice to the end of August. Then come the real winter rains, which cease only in the month of November, and during which torrents of water pour down from the skies.

It was during the winter season that we took up our first abode in the Missions. Every night a thick fog covered the sky, and it was only at intervals that I succeeded in taking some observations of the stars. The thermometer kept from
$18 \cdot 5^{\circ}$ to $20^{\circ}$, which under this zone, and to the sensations of a traveller coming from the coasts, appears a great degree of coolness. I never perceived the temperature in the night at Cumana below $21^{\circ}$. The greatest heat is felt from noon to $3 o^{\prime}$ clock, the thermometer keeping between $26^{\circ}$ and $27^{\circ}$. The maximum of the heat, about two hours after the passage of the sun over the meridian, was very regularly marked by a storm which murmured near. Large black and low clouds dissolved in rain, which came down in torrents : these rains lasted two or three hours, and lowered the thermometer five or six degrees. About five o'clock the rain entirely ceased, the sun reappeared a little before it set, and the hygrometer moved towards the point of dryness ; but at eight or nine we were again enveloped in a thick stratum of vapour. These different changes follow successively, we were assured, during whole months, and yet not a breath of wind is felt. Comparative experiments led us to believe that in general the nights at Cumanacoa are from two to three, and the days from four to five centesimal degrees cooler than at the port of Cumana. These differences are great; and if, instead of meteorological instruments, we consulted only our own feelings, we should suppose they were still more considerable.

The vegetation of the plain which surrounds the town is monotonous, but, owing to the extreme humidity of the air, remarkable for its freshness. It is chiefly characterized by an arborescent solanum, forty feet in height, the Urtica baccifera, and a new species of the genus Guettarda.* The ground is very fertile, and might be easily watered if trenches were cut from a great number of rivulets, the springs of which never dry up during the whole year. The most valuable production of the district is tobacco. Since the introduction of the farm $\dagger$ in 1779, the cultivation of tobacco in the province of Cumana is nearly confined to the valley of Cumanacoa; as in Mexico it is permitted only in

[^69]the two districts of Orizaba and Cordova. The farm system is a monopoly odious to the people. All the tobacco that is gathered must be sold to government; and to prevent, or rather to diminish fraud, it has been found most easy to concentrate the cultivation in one point. Guards scour the country, to destroy any plantations without the boundaries of the privileged districts; and to inform against those inhabitants who smoke cigars prepared by their own hands.

Next to the tobacco of the island of Cuba and of the Rio Negro, that of Cumana is the most aromatic. It excels all the tobacco of New Spain and of the province of Varinas. We shall give some particulars of its culture, which essentially differs from the method practised in Virginia. The prodigious expansion which is remarked in the solaneous plants of the valley of Cumanacoa, especially in the abundant species of the Solanum arborescens, of aquartia, and of cestrum, seems to indicate the favourable nature of this spot for plantations of tobacco. The seed is sown in the open ground, at the beginning of September; though sometimes not till the month of December, which period is however less favourable for the harvest. The cotyledons appear on the eighth day, and the young plants are covered with large leaves of heliconia and plantain, and shelter them from the direct action of the sun. Great care also is taken to destroy weeds, which, between the tropics, spring up with astonishing rapidity. The tobacco is transplanted into a rich and well-prepared soil, a month or two after it has risen from the seed. The plants are disposed in regular rows, three or four feet distant from each other. Care is taken to weed them often, and the principal stalk is several times topped, till greenish blue spots indicate to the cultivator the maturity of the leaves. They begin to gather them in the fourth month, and this first gathering generally terminates in the space of a few days. It would be better if the leaves were plucked only as they dry. In good years the cultivators cut the plant when it is only four feet high; and the shoot which springs from the root, throws out new leaves with such rapidity that they may be gathered on the thirteenth or fourteenth day. These last have the cellular tissue very much extended, and they contain more water, more albumen, and less of that acrid, volatile principle YOL. I.
which is but little soluble in water, and in which the stimulant property of tobacco seems to reside.

At Cumanacoa the tobacco, after being gathered, undergoes a preparation which the Spaniards call cura seca. The leaves are suspended by threads of cocuiza; * their ribs are taken out, and they are twisted into cords. The prepared tobacco should be carried to the king's warehouses in the month of June; but the indolence of the inhabitants, and the preference they give to the cultivation of maize and cassava, usually prevent them from finishing the preparation before the month of August. It is easy to conceive that the leaves, so long exposed to very moist air, must lose some of their flavour. The administrator of the farm keeps the tobacco deposited in the king's warehouses sixty days without touching it. When this time is expired, the manoques are opened to examine the quality. If the administrator find the tobacco well prepared, he pays the cultivator three piastres for the aroba of twenty-five pounds weight. The same quantity is resold for the king's profit at twelve piastres and a half. The tobacco that is rotten (podrido), that is, again gone into a state of fermentation, is publicly burnt; and the cultivator, who has received money in advance from the royal farm, loses irrevocably the fruits of his long labour. We saw heaps, amounting to five hundred arobas, burnt in the great square, which in Europe might have served for making snuff.

The soil of Cumanacoa is so favourable to this branch of culture, that tobacco grows wild, wherever the seed finds any moisture. It grows thus spontaneously at Cerro del Cuchivano, and around the cavern of Caripe. The only kind of tobacco cultivated at Cumanacoa, as well as in the neighbouring districts of Aricagua and San Lorenzo, is that with large sessile leaves, $\dagger$ called Virginia tobacco. The tobacco with petiolate leaves, $\ddagger$ which is the yetl of the ancient Mexicans, is unknown.

In studying the history of our cultivated plants, we are surprised to find that, before the conquest, the use of tobacco was spread through the greater part of America, while the potato was unknown both in Mexico and the West India Islands, where it grows well in the mountainous regions. * Agave Americana. $\dagger$ Nicotiana Tabacum. $\ddagger$ Nicotiana rustica.

Tobacco has also been cultivated in Portugal since the year 1559, though the potato did not become an object of European agriculture till the end of the seventeenth and beginning of the eighteenth century. This latter plant, which has had so powerful an influence on the well-being of society, has spread in both continents more slowly than tobacco, which can be considered only as an article of luxury.

Next to tobacico, the most important culture of the valley of Cumanacoa is that of indigo. The manufacturers of Cumanacoa, of San Fernando, and of Arenas, produce indigo of greater commercial value than that of Caracas; and often nearly equalling in splendour and richness of colour the indigo of Guatimala. It was from that province that the coasts of Cumana received the first seeds of the Indigofera Anil,* which is cultivated jointly with the Indigofera tinctoria. The rains being very frequent in the valley of Cumanacoa, a plant of four feet high yields no more colouring matter than one of a third part that size in the arid valleys of Aragua, to the west of the town of Caracas.

The manufactories we examined are all built on uniform principles. Two steeping vessels, or vats, which receive the plants intended to be brought into a state of fermentation, are joined together. Each vat is fifteen feet square, and two and a half deep. From these upper vats the liquor runs into beaters, between which is placed the water-mill. The axletree of the great wheel crosses the two beaters. It is furnished with ladles, fixed to long handles, adapted for the beating. From a spacious settling-vat, the colouring fecula is carried to the drying place, and spread on planks of brasiletto, which, having small wheels, can be sheltered under a roof in case of sudden rains. Sloping and very low roofs give the drying place the appearance of hot-houses at some distance. In the valley of Cumanacoa, the fermentation of the plant is produced with astonishing rapidity. It lasts in general but four or five hours. This short duration can be attributed only to the humidity of the climate, and the absence of the sun during the development of the plant.

[^70]I think I have observed, in the course of my travels, that the drier the climate, the slower the vat works, and the greater the quantity of indigo, at the minimum of oxidation, contained in the stalks. In the province of Caracas, where 562 cubic feet of the plant slightly piled up yield thirty-five or forty pounds of dry indigo, the liquid does not pass into the beater till after twenty, thirty, or thirty-five hours. It is probable that the inhabitants of Cumanacoa would extract more colouring matter if they left the plants longer steeping in the first vat.* During my abode at Cumana I made solutions of the indigo of Cumanacoa, which is somewhat heavy and coppery, and that of Caracas, in sulphuric acid, in order to compare them, and the solution of the former appeared to me to be of a much more intense blue.
The plain of Cumanacoa, spotted with farms and small plantations of indigo and tobacco, is surrounded with mountains, which towards the south rise to considerable height. Everything indicates that the valley is the bottom of an ancient lake. The mountains, which in ancient times formed its shores, all rise perpendicularly in the direction of the plain. The only outlet for the waters of the lake was on the side of Arenas. In digging foundations, beds of round pebbles, mixed with small bivalve shells, are found; and according to the report of persons worthy of credit, there were discovered, thirty years ago, at the bottom of the ravine of San Juanillo, two enormous femoral bones, four feet long, and weighing more than thirty pounds. The Indians imagined that these were giants' bones; whilst the halflearned sages of the country, who assume the right of explaining everything, gravely asserted that they were mere sports of nature, and little worthy of attention; an opinion founded on the circumstance that human bones decay rapidly in the soil of Cumanacoa. In order to decorate their churches on the festival of the dead, they take skulls from the cemeteries on the coast, where the earth is impregnated with saline substances. These pretended thigh-bones of giants were carried to the port of Cumana, where I sought for them in vain; but from the analogy of some

[^71]fossil bones which I brought from other parts of South America, and which have been carefully examined by M. Cuvier, it is probable that the gigantic femoral bones of Cumanacoa belonged to elephants of a species now extinct. It may appear surprising that they were found in a place so little elevated above the present level of the waters; since it is a remarkable fact, that the fragments of the mastodons and fossil elephants which I brought from the equinoctial regions of Mexico, New Grenada, Quito, and Peru, were not found in low regions (as were the megatherium of Rio Luxan* and Virginia, $\dagger$ the great mastodons of the Ohio, and the fossil elephants of the the Susquehanna, in the temperate zone), but on table-lands having from six to fourteen hundred toises of elevation.

As we approached the southern bank of the basin of Cumanacoa, we enjoyed the view of the Turimiquiri. $\ddagger$ An enormous wall of rocks, the remains of an ancient cliff, rises in the midst of the forests. Farther to the west, at Cerro del Cuchivano, the chain of mountains seems as if broken by the effects of an earthquake. The crevice is more than a hundred and fifty toises wide, is surrounded by perpendicular rocks, and is filled with trees, the interwoven branches of which find no room to spread. This cleft appears like a mine opened by the falling in of the earth. It is intersected by a torrent, the Rio Juagua, and its appearance

* One league south-east from the town of Buenos Ayres.
$\dagger$ The megatherium of Virginia is the megalonyx of Mr. Jefferson. All the enormous remains found in the plains of the new continent, either north or south of the equator, belong, not to the torrid, but to the temperate zone. On the other hand, Pallas observes that in Siberia, consequently also northward of the tropics, fossil bones are never found in mountainous parts. These facts, intimately connected together, seem calculated to lead to the discovery of a great geological law.
$\ddagger$ Some of the inhabitants pronounce this name Tumuriquiri, others Turumiquiri, or Tumiriquiri. During the whole time of our stay at Cumanacoa, the summit of this mountain was covered with clouds. It appeared uncovered on the evening of the llth of September, but only for a few minutes. The angle of elevation, taken from the great square of Cumanacoa, was $8^{\circ} 2^{\prime}$. This determination, and the barometrical measurement which I made on the 13th, may enable us to fix, within a certain approximation, the distance of the mountain at six miles and a third, or 6,050 toises; admitting that the part uncovered by clouds was 850 toises above the plain of Cumanacoa.
is highly picturesque. It is called Risco del Cuchivano. The river rises at the distance of seven leagues southwest, at the foot of the mountain of the Brigantine, and it forms some beautiful cascades before it spreads through the plain of Cumanacoa.

We visited several times a small farm, the Conuco of Bermudez, opposite the Risco del Cuchivano, where tobacco, plantains, and several species of cotton-trees,* are cultivated in the moist soil ; especially that tree, the cotton of which is of a nankeen colour, and which is so common in the island of Margareta. $\dagger$ The proprietor of the farm told us that the Risco or crevice was inhabited by jaguar tigers. These animals pass the day in caverns, and roam around human habitations at night. Being well fed, they grow to the length of six feet. One of them had devoured, in the preceding year, a horse belonging to the farm. He dragged his prey on a fine moonlight night, across the savannah, to the foot of a ceiba $\ddagger$ of an enormous size. The groans of the dying horse awoke the slaves of the farm, who went out armed with lances and machetes. $\|$ The tiger, crouching over his prey, awaited their approach with tranquillity, and fell only after a long and obstinate resistance. This fact, and many others verified on the spot, prove that the great jaguar§ of Terra Firma, like the jaguarete of Paraguay, and the real tiger of Asia, does not flee from man when it is dared to close combat, and when not intimidated by the number of its assailants. Naturalists at present admit that Buffon was entirely mistaken with respect to the greatest of the feline race of America. What Buffon says of the cowardice of tigers of the new continent, relates to the small ocelots. ${ }^{1 /}$ At the Orinoco, the real jaguar of America

[^72]sometimes leaps into the water, to attack the Indians in their canoes.
Opposite the farm of Bermudez, two spacious caverns open into the crevice of Cuchivano, whence at times there issue flames, which may be seen at a great distance in the night; and, judging by the elevation of the rocks, above which these fiery exhalations ascend, we should be led to think that they rise several hundred feet. This phenomenon was accompanied by a subterranean, dull, and long continued noise, at the time of the last great earthquake of Cu mana. It is observed chiefly during the rainy season; and the owners of the farms opposite the mountain of Cuchivano allege that the flames have become more frequent since December 1797.

In a herborizing excursion we made at Rinconada we attempted to penetrate into the crevice, wishing to examine the rocks which seemed to contain in their bosom the cause of these extraordinary conflagrations ; but the strength of the vegetation, the interweaving of the lianas, and thorny plants, hindered our progress. Happily the inhabitants of the valley themselves felt a warm interest in our researches, less from the fear of a volcanic explosion, than because their minds were impressed with the idea that the Risco del Cuchivano contained a gold mine; and although we expressed our doubts of the existence of gold in a secondary limestone, they insisted on knowing "what the German miner thought of the richness of the vein." Ever since the time of Charles V. and the government of the Welsers, the Alfingers, and the Sailers, at Coro and Caracas, the people of Terra Firma have entertained a great confidence in the Germans with respect to all that relates to the working of mines. Wherever I went in South America, when the place of my birth was known, I was shown samples of ore. In these colonies every Frenchman is supposed to be a physician, and every German a miner.

The farmers, with the aid of their slaves, opened a path across the woods to the first fall of the Rio Juagua; and on the 10th of September we made our excrrsion to the Cuchivano. On entering the crevice we recognised the proximity of tigers by a porcupine recently embowelled. For greater security the Indians returned to the farm, and brought back
some dogs of a very small breed. We were assured that in the event of our meeting a jaguar in a narrow path he would spring on the dog rather than on a man. We did not proceed along the brink of the torrent, but on the slope of the rocks which overhung the water. We walked on the side of a precipice from two to three hundred feet deep, on a kind of very narrow cornice, like the road which leads from the Grindelwald along the Mettenberg to the great glacier. When the cornice was so narrow that we could find no place for our feet, we descended into the torrent, crossed it by fording, and then climbed the oppositte wall. These descents are very fatiguing, and it is not safe to trust to the lianas, which hang like great cords from the tops of the trees. The creeping and parasite plants cling but feebly to the branches which they embrace; the united weight of their stalks is considerable, and you run the risk of pulling down a whole mass of verdure, if, in walking on a sloping ground, you support your weight by the lianas. The farther we advanced the thicker the vegetation became. In several places the roots of the trees had burst the calcareous rock, by inserting themselves into the clefts that separate the beds. We had some trouble to carry the plants which we gathered at every step. The cannas, the heliconias with fine purple flowers, the costuses, and other plants of the amomum family, here attain eight or ten feet in height, and their fresh tender verdure, their silky gloss, and the extraordinary development of the parenchyma, form a striking contrast with the brown colour of the arborescent ferns, the foliage of which is delicately shaped. The Indians made incisions with their large knives in the trunks of the trees, and fixed our attention on those beautiful red and gold-coloured woods, which will one day be sought for by our turners and cabinet-makers. They showed us a plant of the compositm order, twenty feet high (the Eupatorium lævigatum of Lamarck), the rose of Belveria,* celebrated for the brilliancy of its purple flowers, and the dragon's-blood of this country, which is a kind of croton not yet described. $\dagger$ The red and

[^73]astringent juice of this plant 18 employed to strengthen the gums. The Indians recognize the species by the smell, and more particularly by chewing the woody fibres. Two natives, to whom the same wood was given to chew, pronounced without hesitation the same name. We could avail ourselves but little of the sagacity of our guides, for how could we procure leaves, flowers, and fruits growing on trunks, the branches of which commence at fifty or sixty feet high? We were struck at finding in this hollow the bark of trees, and even the soil, covered with moss* and lichens. The cryptogamous plants are here as common as in northern countries. Their growth is favoured by the moisture of the air, and the absence of the direct rays of the sun. Nevertheless the temperature is generally at $25^{\circ}$ in the day, and $19^{\circ}$ at night.

The rocks which bound the crevice of Cuchivano are perpendicular like walls, and are of the same calcareous formation which we observed the whole way from Punta Delgada. It is here a blackish grey, of compact fracture, tending sometimes towards the sandy fracture, and crossed by small veins of white carbonated lime. In these characteristic marks we thought we discovered the alpine limestone of Switzerland and the Tyrol, of which the colour is always deep, though in a less degree than that of the transition limestone. $t$ The first of these formations constitutes the Cuchivano, the nucleus of the Imposible, and in general the whole group of the mountains of New Andalusia. I saw no petrifactions in it; but the inhabitants assert that considerable masses of shells are found at great heights. The same phenomenon occurs in the country about Salzburg. $\ddagger$ At the Cuchivano the alpine limestone contains beds of marly clay,§ three or resins found in the forests of Cumana, makes a just distinction between the Draco de la Sierra de Unare, which has pinnate leaves (Pterocarpus Draco), and the Draco de la Sierra de Paria, with entire and hairy leaves. The latter is the Croton sanguifluum of Cumanacoa, Caripe, and Cariaco.

* Real musci frondosi. We also found, besides a small Boletus stipitatus, of a snow-white colour, the Boletus igniarius, and the Lycoperdon stellatum of Europe. I had found this last only in very dry places in Germany and Poland.
$\dagger$ Escher, in the "Alpina," vol. iv., p. 340.
$\ddagger$ In Switzerland, the solitary beds of shells, at the height of from 1,300 to 2,000 toises, (in the Jungfrauhorn, the Dent de Morcle, and the Dent du Midi, belong to transition limestone. \& Mergelschiefer.
four toises thick; and this geological fact proves on the one hand the identity of the alpenkalkstein with the zechstein of 'Thuringia, and on the other the affinity of formation existing. between the alpine limestone and that of the Jura.* The. strata of marl effervesce with acids, though silex and alumina predominate in them: they are strongly impregnated with carbon, and sometimes blacken the hands, like a real vitriolic schistus. The supposed gold mine of Cuchivano, which was the object of our examination, is nothing but an excavation cut into one of those black strata of marl, which contain pyrites in abundance. The excavation is on the right bank of the river Juagua, and must be approached with caution, because the torrent there is more than eight feet deep. The sulphurous pyrites are found, some massive, and others cryscopper. They are mixed with fibrous that they contain and nodules of swinestone, or fetid marly stratum crosses the torrent; and, as the lime. The
* The Jura and the Alpine limestone ard, as the water washes are sometimes difficult to be distinguished, where formations, and they one upon another, as in the Apennines. where they lie immediately zechstein, famous among the geologists of Freyberg, are identical formations This identity, which I noticed in the year 1793 (U), are identical formations. is a geological fact the more interesting, as it seems to unitetter), northern European formations to those of the that the zechstein is situated bo those of the central chain. It is known conglomerate (ancient sandstone); the muriatiferous gypsum and the gypsum, between the slaty sandstone with there is no muriatiferous Wern.), and the conglomerate or ancient sandstones (bunte sandstein, of schistous and coppery marl (bituminoce mergel and contains strata which form an important object in the wock mergel and kupferschiefer) Saxony, near Riegelsdorf in Hesse, and working of mines at Mansteld in In the southern part of Bavaria (Oberbziern) containing these same strata of schistous , I saw the alpine limestone, thinner, whiter, and especially more frequent and marl, which, though of Jura. Respecting the slates of Blequent, characterize the limestone which some mineralogists, because of their nerg, in the canton of Glaris, have long mistaken for the cupreous slates numerous impressions of fish, according to M. von Buch, to a real transition Mansfeld, they belong. geological data tend to prove that strata of marlpation. All these with carbon, are to be found in the limestone marl, more or less mixed store, and in the transition schists. The me of Jura, in the alpine limeiron, and copper, appears to me to augment with of carbon, sulphuretted the formations.
out metallic grains, the people imagine, on account of the brilliancy of the pyrites, that the torrent bears down gold. It is reported, that, after the great earthquake which took place in 1766, the waters of the Juagua were so charged with gold, that " men who came from a great distance, and whose country was unknown," established washing-places on the spot. They disappeared during the night, after having collected a great quantity of gold. It would be needless to show that this is a fable. Pyrites dispersed in quartzose veins, crossing the mica-slate, are often auriferous, no doubt; but no analogous fact leads to the supposition that the sulphuretted iron which is found in the schistose marls of the alpine limestone, contains gold. Some direct experiments, made with acids, during my abode at Caracas, showed that the pyrites of Cuchivano are not auriferous. Our guides were amazed at my incredulity. In vain I repeated that alum and sulphate of iron only could be obtained from this supposed gold mine; they continued picking up secretly every bit of pyrites they saw sparkling in the water. In countries possessing few mines, the inhabitants entertain exaggerated ideas respecting the facility with which riches are drawn from the bowels of the earth. How much time did we not lose during five years' travels, in visiting, on the pressing invitations of our hosts, ravines, of which the pyritous strata have borne for ages the imposing names of 'Minas de oro!' How often have we been grieved to see men of all classes, magistrates, pastors of villages, grave missionaries, grinding, with inexhaustible patience, amphibole, or yellow mica, in the hope of extracting gold from it by means of mercury! This rage for the search of mines strikes us the more in a climate where the ground needs only to be slightly raked to produce abundant harvests.

After visiting the pyritous marls of the Rio Juagua, we continued following the course of the crevice, which stretches along like a narrow canal overshadowed by very lofty trees. We observed strata on the left bank, opposite Cerro del Cuchivano, singularly crooked and twisted. This phenomenon I had often admired at the Ochsenberg,* in passing the

* This mountain of Switzerlaad is composed of transition limestone. We find these same inflexions in the strata near Bonneville, at Nante
lake of Lucerne. The calcareous beds of the Cuchivano and the neighbouring mountains keep pretty regularly the direction of N.N.E. and S.S.W. Their inclination is sometimes north and sometimes south; most commonly they seem to take a direction towards the valley of Cumanacoa; and it cannot be doubted that the valley has an influence* on the inclination of the strata.

We had suffered great fatigue, and were quite drenched by frequently crossing the torrent, when we reached the caverns of the Cuchivano. A wall of rock there rises perpendicularly to the height of eight hundred toises. It is seldom that in a zone where the force of vegetation everywhere conceals the soil and the rocks, we behold a great mountain presenting naked strata in a perpendicular section. In the middle of this section, and in a position unfortunately inaccessible to man, two caverns open in the form of crevices. We were assured that they are inhabited by nocturnal birds, the same as those we were soon to become acquainted with in the Cueva del Guacharo of Caripe. Near these caverns we saw strata of schistose marl, and found, with great astonishment, rock-crystals encased in beds of alpine limestone. They were hexahedral prisms, terminated with pyramids, fourteen lines long and eight thick. The crystals, perfectly transparent, were solitary, and often three or four toises distant from each other. They were enclosed in the calcareous mass, as the quartz crystals of Burgtonna, $\dagger$ and the boracite of Lunebourg, are contained in gypsum. There was no crevice near, or any vestige of calcareous spar. $\ddagger$
d'Arpenas in Savoy, and in the valley of Estaubee in the Pyrenees. Another transition rock, the grauwakke of the Germans (very near the English killas), exhibits the same phenomenon in Scotland.

* The same observation may apply to the lake of Gemunden in Styria, which I visited with M. von Buch, and which is one of the most picturesque situations in Europe.
$\dagger$ In the duchy of Gotha.
$\ddagger$ This phenomenon reminds us of another equally rare, the quartz crystals found by M. Freiesleben in Saxony, near Burgörner, in the county of Mansfeld, in the middle of a rock of porous limestone (rauchwakke), lying immediately on the alpine limestone. The rock crystals, which are pretty common in the primitive limestone of Carrara, line the insides of cavities in the rocks, without being enveloped by the rock itself.

We reposed at the foot of the cavern whence those flames were seen to issue, which of late years have become more frequent. Our guides and the farmer, an intelligent man, equally acquainted with the localities of the province, discussed, in the manner of the Creoles, the dangers to which the town of Cumanacoa would be exposed if the Cuchivano became an active volcano, or, as they expressed it, "se veniesse a reventar." It appeared to them evident, that since the great earthquakes of Quito and Cumana in 1797, New Andalusia was every day more and more undermined by subterranean fires. They cited the flames which had been seen to issue from the earth at Cumana; and the shocks felt in places where heretofore the ground had never been shaken. They recollected that at Macarapan, sulphurous emanations had been frequently perceived for some months past. We were struck with these facts, upon which were founded predictions that have since been almost all realized. Enormous convulsions of the earth took place at Caracas in 1812, and proved how tumultuously nature is agitated in the north-east part of Terra-Firma.

But what is the cause of the luminous phenomena which are observed in the Cuchivano? The column of air which rises from the mouth of a burning volcano* is sometimes observed to shine with a splendid light. This light, which is believed to be owing to the hydrogen gas, was observed from Chillo, on the summit of the Cotopaxi, at a time when the mountain seemed in the greatest repose. According to the statements of the ancients, the Mons Albanus, near Rome, known at present under the name of Monte Cavo, appeared at times on fire during the night; but the Mons Albanus is a volcano recently extinguished, which, in the time of Cato, threw out rapilli ; $\dagger$ while the Cuchivano is a calcareous mountain, remote from any trap formation.

[^74]Can these flames be attributed to the decomposition of water, entering into contact with the pyrites dispersed through the schistose marl? or is it inflamed hydrogen that issues from the cavern of Cuchivano? The marls, as the smell indicates, are pyritous and bituninous at the same time; and the petroleum springs at the Buen Pastor, and in the island of Trinidad, proceed probably from these same beds of alpine limestone. It would be easy to suppose some connexion between the waters filtering through this calcareous stone, and decomposed by pyrites and the earthquakes of Cumana, the springs of sulphuretted hydrogen in New Barcelona, the beds of native sulphur at Carupano, and the emanations of sulphurous acid which are perceived at times in the savannahs. It cannot be doubted also, that the decomposition of water by the pyrites at an elevated temperature, favoured by the affinity of oxidated iron for earthy substances, may have caused that disengagement of hydrogen gas, to the action of which several modern geologists have attributed so much importance. But in general, sulphurous acid is perceived more commonly than hydrogen in the eruption of volcanoes, and the odour of that acid principally prevails while the earth is agitated by violent shocks. When we take a general view of the phenomena of volcanoes and earthquakes, when we recollect the enormous distance at which the commotion is propagated below the basin of the sea, we readily discard explanations founded on small strata of pyrites and bituminous marls. I am of opinion that the shocks so frequently felt in the province of Cu mana are as little to be attributed to the rocks above the surface of the earth, as those which agitate the Apennines are assignable to asphaltic veins or springs of burning petroleum. The whole of these phenomena depend on more general, I would almost say on deeper, causes ; and it is not in the secondary strata which form the exterior crust of our globe, but in the primitive rocks, at an enormous distance from the soil, that we should seek the focus of volcanic action. The greater progress we make in geology, the more we feel the insufficiency of theories founded on observations merely local.

On the 12th of September we continued our journey to the convent of Caripe, the principal settlement of the

Chayma missions. We chose, instead of the direct road, that by the mountains of the Cocollar* and the Turimiquiri, the height of which little exceeds that of Jura. The road first runs eastward, crossing over the length of three leagues the table-land of Cumanacoa, in a soil formerly levelled by the waters: it then turns to the south. We passed the little Indian village of Aricagua surrounded by woody hills. Thence we began to ascend, and the ascent lasted more than four hours. We crossed two-and-twenty times the river of Pututucuar, a rapid torrent, full of blocks of calcareous rock. When, on the Cuesta del Oocollar, we reached an elevation two thousand feet above the level of the sea, we were surprised to find scarcely any forests or great trees. We passed over an immense plain covered with gramineous plants. Mimosas with hemispheric tops, and stems only four or five feet high, alone vary the dull uniformity of the savannahs. Their branches are bent towards the ground or spread out like umbrellas. Wherever there are deep declivities, or masses of rocks half covered with mould, the clusiz or cupey, with great nymphea flowers, displays its beantiful verdure. The roots of this tree are eight inches in diameter, and they sometimes shoot out from the trunk at the height of fifteen feet above the soil.

After having climbed the mountain for a considerable time, we reached a small plain at the Hato del Cocollar. This is a solitary farm, situated on a table-land 408 toises high. We rested three days in this retreat, where we were treated with great kindness by the proprietor, Don Mathias Yturburi, a native of Biscay, who had accompanied us from the port of Cumana. We there found milk, excellent meat from the richness of the pasture, and above all, a delightful climate. During the day the centigrade thermometer did not rise above $22^{\circ}$ or $23^{\circ}$; a little before sunset it fell to $19^{\circ}$, and at night it scarcely kept up to $14^{\circ} . \dagger^{\dagger}$ The nightly temperature was consequently seven degrees colder than that of the coasts, which is a fresh proof of an extremely rapid

[^75]decrement of heat, the table-land of Cocollar being less elevated than the site of the town of Caracas.

As far as the eye could reach, we perceived, from this elevated point, only naked savannahs. Small tufts of scattered trees rise in the ravines; and notwithstanding the apparent uniformity of vegetation, great numbers of curious plants* are found here. We shall only speak of a superb lobelia $\dagger$ with purple flowers; the Brownea coccinea, which is upwards of a hundred feet high; and above all, the pejoa, celebrated in the country on account of the delightful and aromatic perfume emitted by its leaves when rubbed between the fingers. $\ddagger$ But the great charms of this solitary place were the beauty and serenity of the nights. The proprietor of the farm, who spent his evenings with us, seemed to enjoy the astonishment produced on Europeans newly transplanted to the tropics, by that vernal freshness of the air which is felt on the mountains after sunset. In those distant regions, where men yet feel the full value of the gifts of nature, a land-holder boasts of the water of his spring, the absence of noxious insects, the salutary breeze that blows round his hill, as we in Europe descant on the conveniences of our dwellings, and the picturesque effect of our plantations.

Our host had visited the new world with an expedition which was to form establishments for felling wood for the Spanish navy on the shores of the gulf of Paria. In the vast forests of mahogany, cedar, and brazil-wood, which border the Caribbean Sea, it was proposed to select the

[^76]trunks of the largest trees, giving them in a rough way the shape adapted to the building of ships, and sending them every year to the dockyard near Cadiz. White men, unaccustomed to the climate, could not support the fatigue of labour, the heat, and the effect of the noxious air exhaled by the forests. The same winds which are loaded with the perfume of flowers, leaves, and woods, infuse also, as we may say, the germs of dissolution into the vital organs. Destructive fevers carried off not only the ship-carpenters, but the persons who had the management of the establishment ; and this bay, which the early Spaniards named Golfe Triste (Melancholy Bay), on account of the gloomy and wild aspect of its coasts, became the grave of European seamen. Our host had the rare good fortune to escape these dangers. After having witnessed the death of a great number of his friends, he withdrew from the coast to the mountains of Cocollar.

Nothing can be compared to the majestic tranquillity which the aspect of the firmament presents in this solitary region. When tracing with the eye, at night-fall, the meadows which bounded the horizon,-the plain covered with verdure and gently undulated, we thought we beheld from afar, as in the deserts of the Orinoco, the surface of the ocean supporting the starry vault of Heaven. The tree under which we were seated, the luminous insects flying in the air, the constellations which shone in the south; every object seemed to tell us how far we were from our native land. If amidst this exotic nature we heard from the depth of the valley the tinkling of a bell, or the lowing of herds, the remembrance of our country was awakened suddenly. The sounds were like distant voices resounding from beyond the ocean, and with magical power transporting us from one hemisphere to the other. Strange mobility of the imagination of man, eternal source of our enjoyments and our pains!

We began in the cool of the morning to climb the Turimiquiri. This is the name given to the summit of the Cocollar, which, with the Brigantine, forms one single mass of mountain, formerly called by the natives the Sierra de los Tageres. We travelled along a part of the road on horses, which roam about these savanuahs; but some of them are

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used to the saddle. Though their appearance is very heavy, they pass lightly over the most slippery turf. We first stopped at a spring issuing, not from the calcareous rock, but from a layer of quartzose sandstone. The temperature was $21^{\circ}$, consequently $1.5^{\circ}$ less than the spring of Quetepe; and the difference of the lerel is nearly 220 toises. Whereewer the sandstone appears above ground the soil is level, and constitutes as it were small platforms, succeeding each other like steps. To the height of 700 toises, and even beyond, this mountain, like those in its vicinity, is covered only with gramineous plants.* The absence of trees is attributed at Cumana to the great elevation of the ground; but a slight reflection on the distribution of plants in the Cordilleras of the torrid zone will lead us to conceive that the summits of New Andalusia are very far from reaching the superior limit of the trees, which in this latitude is at least 1800 toises of absolute height. The smooth turf of the Cocollar begins to appear at 350 toises above the level of the sea, and the traveller may contrive to walk upon this turf till he reaches a thousand toises in height. Farther on, beyond this band covered with gramineous plants, we found, amidst peaks almost inaccessible to man, a small forest of cedrela, javillo, $\uparrow$ and mahogany. These local circumstances induce me to think that the mountainous savannahs of the Cocollar and Turimiquiri owe their existence only to the destructive custom practised by the natives of setting fire to the woods when they want to convert the soil into pasturage. Where, during the lapse of three centuries, grasses and alpine plants have covered the soil with a thick carpet, the seeds of trees can no longer germinate and fix themselves in the earth, though birds and winds convey them continually from the distant forests into the savannahs.

* The most abundant species are the paspalus; the Andropogon fastigiatum, which forms the genus Diectomis of M. Palissot de Beauvais; and the Panicum olyroides.
+Huras crepitans, of the family of the euphorbias. The growth of its trunk is so enormous, that M. Bonpland measured vats of javillo wood, 14 feet long and 8 wide. These vats, made from one log of wood, are employed to keep the guarapo, or juice of the sugar-cane, and the molasses. The seeds of javillo are a very active poison, and the milk that issues from the petioles, when broken, frequently produced inflammation in our eyes, if by chance the least quantity penetrated under the eyelids.

The climate of these mountains is so mild that at the farm of the Cocollar the cotton and coffee tree, and even the sugar cane, are cultivated with success. Whatever the inhabitants of the coasts may allege, hoar-frost has never been found in the latitude of $10^{\circ}$, on heights scarcely exceeding those of the Mont d'Or, or the Puy-de-Dôme. The pastures of Turimiquiri become less rich in proportion to the elevation. Wherever scattered rocks afford shade, lichens and some European mosses are found. The Melastoma guacito,* and a shrub, the large and tough leaves of which rustle like parchment $\dagger$ when shaken by the winds, rise here and there in the savannah. But the principal ornament of the turf of these mountains is a liliaceous plant with golden flowers, the Marica martinicensis. It is generally observed in the province of Cumana and Caracas only at 400 or 500 toises of elevation $\ddagger$ The whole rocky mass of the Turimiquiri is composed of an alpine limestone, like that of Cumanacoa, and a pretty thin strata of marl and quartzose sandstone. The limestone contains masses of brown oxidated iron and carbonate of iron. I have observed in several places, and very distinctly, that the sandstone not only reposes on the limestone, but that this last rock frequently includes and alternates with the sandstone.

We distinguished clearly the round summit of the Turimiquiri and the lofty peaks or, as they are called, the Cucuruchos, covered with thick vegetation, and infested by tigers which are hunted for the beauty of their skin. This round summit, which is covered with turf, is 707 toises above the level of the ocean. A ridge of steep rocks stretches out westward, and is broken at the distance of a mile by an enormous crevice that descends toward the gulf of Cariaco. At the point which might be supposed to be the continuation of the ridge, two calcareous paps or peaks arise, the most northern of which is the loftiest. It is this last which is more particularly called the Cucurucho de Turimiquiri,

[^77]and which is considered to be higher than the mountain of the Brigantine, so well known by the sailors who frequent the coasts of Cumana. We measured, by angles of elevation, and a basis, rather short, traced on the round summit, the peak of Cucurucho, which was about 350 toises higher than our station, so that its absolute height exceeded 1050 toises.

The view we enjoyed on the Turimiquiri is of vast extent, and highly picturesque. From the summit to the ocean we perceived chains of mountains extended in parallel lines from east to west, and bounding longitudinal valleys. These valleys are intersected at right angles by an infinite number of small ravines, scooped out by the torrents: the consequence is, that the lateral ranges are transformed into so many rows of paps, some round and others pyramidal. The ground in general is a gentle slope as far as the Imposible; farther on the precipices become bold, and continue so to the shore of the gulf of Cariaco. The form of this mass of mountains reminded us of the chain of the Jura; and the only plain that presents itself is the valley of Cumanacoa.' We seemed to look down into the bottom of a funnel, in which we could distinguish, amidst tufts of scattered trees, the Indian village of Aricagua. Towards the north, a narrow slip of land, the peninsula of Araya, formed a dark stripe on the sea, which, being illumined by the rays of the sun, reflected a strong light. Beyond the peninsula the horizon was bounded by Cape Macanao, the black rocks of which rise amid the waters like an immense bastion.

The farm of the Cocollar, situated at the foot of the Turimiquiri, is in latitude $19^{\circ} 9^{\prime} 32^{\prime \prime}$. I found the dip of the needle $42 \cdot 1^{\circ}$. The needle oscillates 229 times in ten minutes. Possibly masses of brown iron-ore, included in the calcareous rock, caused a slight augmentation in the intensity of the magnetic forces.

On the 14th of September we descended the Cocollar, toward the Mission of San Antonio. After crossing several savannahs strewed with large blocks of calcareous stone, we entered a thick forest. Having passed two ridges of extremely steep mountains,* we discovered a fine valley five or six

[^78]leagues in length, pretty uniformly following the direction of east and west. In this valley are situated the Missions of San Antonio and Guanaguana; the first is famous on account of a small church with two towers, built of brick, in pretty good style, and ornamented with columns of the Doric order. It is the wonder of the country. The prefect of the Capuchins completed the building of this church in less than two summers, though he employed only the Indians of his village. The mouldings of the capitals, the cornices, and at frieze decorated with suns and arabesques, are executed in clay mixed with pounded brick. If we are surprised to find churches in the purest Grecian style on the confines of Lapland,* we are still more struck with these first essays of art, in a region where everything indicates the wild state of man, and where the basis of civilization has not been laid by Europeans more than forty years.

I stopped at the Mission of San Antonio only to open the barometer, and to take a few altitudes of the sun. The elevation of the great square above Cumana is 216 toises. After having crossed the village, we forded the rivers Colorado and Guarapiche, both of which rise in the mountains of the Cocollar, and blend their waters lower down towards the east. The Colorado has a very rapid current, and becomes at its mouth broader than the Rhine. The Guarapiche, at its junction with the Rio Areo, is more than twenty-five fathoms deep. Its banks are ornamented by a superb gramen, of which I made a drawing two years afterward on ascending the river Magdalena. The distich-leaved stalk of this gramen often reaches the height of fifteen or twenty feet. $\dagger$

Towards evening we reached the Mission of Guanaguana, the site of which is almost on a level with the village of San Antonio. The missionary received us cordially; he was an old man, and he seemed to govern his Indians with great

* At Skelefter, near Torneo.-Buch, Voyage en Norwège.
$\dagger$ Lata, or caña brava. It is a new genus, between aira and arundo. This colossal gramen looks like the donax of Italy. This, the arundinaria of the Mississippi, (ludolfia, Willd., miegia of Persoon,) and the bamboos, are the highest gramens of the New Continent. Its seed has been carried to St. Domingo, where its stalk is employed to thatch the pegroes' huts.
intelligence. The village has existed only thirty years on the spot it now occupies. Before that time it was more to the south, and was backed by a hill. It is astonishing with what facility the Indians are induced to remove their dwellings. There are villages in South America which in less than half a century have thrice changed their situation. The native finds himself attached by ties so feeble to the soil he inhabits, that he receives with indifference the order to take down his house and to rebuild it elsewhere. A village changes its situation like a camp. Wherever clay, reeds, and the leaves of the palm or heliconia are found, a house is built in a few days. These compulsory changes have often no other motive than the caprice of a missionary, who, having recently arrived from Spain, fancies that the situation of the Mission is feverish, or that it is not sufficiently exposed to the winds. Whole villages have been transported several leagues, merely because the monk did not find the prospect from his house sufficiently beautiful or extensive.

Gaanaguana has as yet no church. The old monk, who during thirty years had lived in the forests of America, observed to us that the money of the community, or the produce of the labour of the Indians, was employed first in the construction of the missionary's house, next in that of the church, and lastly in the clothing of the Indians. He gravely assured us that this order of things could not be changed on any pretence, and that the Indians, who prefer a state of nudity to the slightest clothing, are in no hurry for their turn in the destination of the fumds. The spacious abode of the padre had jast been finished, and we had remarked with surprise, that the house, the roof of which formed a terrace, was furnished with a great number of chimmies that looked like turrets. This, our host told us, was done to remind him of a country dear to his recollection, and to picture to his mind the winters of Aragon amid the heat of the torrid zone. The Indians of Guanaguana cultivate cotton for their own benefit as well as for that of the church and the missionary. The natives have machines of a very simple construction to separate the cotton from the seeds. These are wooden cylinders of extremely small diameter, within which the cotton passes, and which are made to turn by a treadle. These machines, howerer imperfect,
are very useful, and they begin to be imitated in other Missions. The soil of Guanaguana is not less fertile than that of Aricagua, a small neighbouring village, which has also preserved its ancient Indian name. An almuda of land, 1850 square toises, produces in abundant years from 25 to 30 fanegas of maize, each fanega weighing 100 pounds. But here, as in other places, where the bounty of nature retards industry, a very small number of acres are cleared, and the culture of alimentary plants is neglected. Scarcity of subsistence is felt, whenever the harvest is lost by a profracted drought. The Indians of Guanaguana related to us as a fact. not uncommon, that in the preceding year they, their wives, and their children, had been for three months al monte; by which they meant, wandering in the neighbouring forests, to live on succulent plants, palm-cabbages, fern roots, and fraits of wild trees. They did not speak of this nomade life as of a state of privation.

The beautiful valley of Guanaguana stretches towards .the east, opening into the plains of Punzera and Terecen. We wished to visit those plains, and examine the springs of petroleum, lying between the river Guarapicheand the Rio Areo; but the rainy season had already arrived, and we were in daily perplexity how to dry and preserve the plants we had collected. The road from Guanaguana to the village of Punzera runs either by San Felix or by Caycara and Guayuta, which is a farm for cattle (hato) of the missionaries. In this last place, according to the report of the Indians, great masses of sulphur are found, not in a gypseous or calcareous rock, but at a small depth below the soil, in a bed of clay. This singular phenomenon appears to me peculiar to America; we found it also in the kingdom of Quito, and in New Spain. On approaching Punzera, we saw in the savannahs small bags, formed of a silky tissue suspended from the branches of the lowest trees. It is the seda silvestre, or wild silk of the country, which has a beautiful lustre, but is very rough to the touch. The phalæna which produces it is probably analagous with that of the provinces of Guanaxuato and Antioquia, which also furnish wild silk. We found in the beautiful forest of Punzera two trees known by the names of curucay and canela; the former, of which
we shall speak hereafter, yields a resin very much sought after by the Piaches, or Indian sorcerers; the leaves of the latter have the smell of the real cinnamon of Ceylon.* From Punzera the road leads by Terecin and Nueva Palencia, (a new colony of Canarians,) to the port of San Juan, situated on the right bank of the river Areo; and it is only by crossing this river in a canoe, that the traveller can arrive at the famous petroleum springs (or mineral tar) of the Buen Pastor. They were described to us as small wells or funnels, hollowed out by nature in a marshy soil. This phenomenon reminded us of the lake of asphaltum, or of chapapote, in the island of Trinidad, $\dagger$ which is distant from the Buen Pastor, in a straight line, only thirty-five sea leagues.

Having long struggled to overcome the desire we felt to descend the Guarapiche to the Golfo Triste, we took the direct road to the mountains. The valleys of Guanaguana and Caripe are separated by a kind of dyke, or calcareous ridge, well known by the name of the Cuchilla $\ddagger$ de Guanaguana. We found this passage difficult, because at that time we had not climbed the Cordilleras; but it is by no means so dangerous as the people at Cumana love to represent it. The path is indeed in several parts only fourteen or fifteen inches broad; and the ridge of the mountain, along which the road runs, is covered with a short slippery turf. The slopes on each side are steep, and the traveller, should he stumble, might slide down to the depth of seven or eight hundred feet. Nevertheless, the flanks of the mountain are steep declivities rather than precipices; and the mules of this country are so sure-footed

[^79]that they inspire the greatest confidence. Their habits are identical with those of the beasts of burden in Switzerland and the Pyrenees. In proportion as a country is wild, the instinct of domestic animals improves in address and sagacity. When the mules feel themselves in danger, they stop, turning their heads to the right and to the left; and the motion of their ears seems to indicate that they reflect on the decision they ought to take. Their resolution is slow, but always just, if it be spontaneous; that is to say, if it be not thwarted or hastened by the imprudence of the traveller. On the frightful roads of the Andes, during journeys of six or seven months across mountains furrowed by torrents, the intelligence of horses and beasts of burden is manifested in an astonishing manner. Thus the mountaineers are heard to say, "I will not give you the mule whose step is the easiest, but the one which is most intelligent (la mas racional)." This popular expression, dictated by long experience, bears stronger evidence against the theory of animated machines, than all the arguments of speculative philosophy.

When we had reached the highest point of the ridge or cuchilla of Guanaguana, an interesting spectacle unfolded itself before us. We saw comprehended in one view the vast savannahs or meadows of Maturin and of the Rio Tigre;" the peak of the Turimiquiri ; $\dagger$ and an infinite number of parallel ridges, which, seen at a distance, looked like the waves of the sea. On the north-east opens the valley in which is situated the convent of Caripe. The aspect of this valley is peculiarly attractive, for being shaded by forests, it forms a strong contrast with the nudity of the neighbouring mountains, which are bare of trees, and covered with gramineous plants. We found the absolute height of the Cuchilla to be 548 toises.

Descending from the ridge by a winding path, we entered into a completely woody country. The soil is covered with moss, and a new species of drosera, § which by its form reminded us of the drosera of the Alps. The thickness of the forests, and the force of vegetation, augmented

[^80]as we approached the convent of Caripe. Everything here changes its aspect, even to the rock that accompanied us from Punta Delgada. The calcareous strata becomes thinner, forming graduated steps, which stretch out like walls, cornices, and turrets, as in the mountains of Jura, those of Pappenheim in Germany, and near Oizow in Galicia. The colour of the stone is no longer of a smoky or bluish grey; it becomes white; its fracture is smooth, and sometimes even imperfectly conchoidal. It is no longer the calcareous formation of the Higher Alps, but a formation to which this serves as a basis, and which is analagous to the Jura limestone. In the chain of the Apennines, between Rome and Nocera, I observed this same inmediate superposition.* It indicates, not the transition from one rock to another, but the geological affinity existing between two formations. According to the general type of the secondary strata, recognised in a great part of Europe, the Alpine limestone is separated from the Jura limestone by the muriatiferous gypsum ; but often this latter is entirely wanting, or is conlained as a subordinate layer in the Alpine limestone. In this case the two great calcareous formations succeed each other immediately, or are confounded in one mass.

The descent from the Cuchilla is far shorter than the ascent. We found the level of the ralley of Caripe 200 toises higher than that of the valley of Guanaguana. + A group of mountains of little breadth separates two valleys, one of which is of delicious coolness, while the other is famed for the heat of its climate. These contrasts, so common in Mexico, New Grenada, and Peru, are very rare in the north-east part of South America. Thus Caripe is the only one of the high valleys of New Andalusia which is much inhabited.

- In like manner, near Geneva, the rock of the Mole, belonging to the Alpine limestone, lies under the Jura limestone which forms Mount Salève.
+ Absolute height of the convent above the level of the sea, 412 toises.


## Chapter VII. <br> Convent of Caripe.-Cavern of the Guacharo.-Nocturnal Birds.

An alley of perseas led us to the Hospital of the Aragonese Capuchins. We stopped near a cross of Brazil-wood, erected in the midst of a square, and surrounded with benches, on which the infirm monks seat themselves to tell their rosaries. The convent is backed by an enormous wall of perpendicular rock, covered with thick vegetation. The stone, which is of resplendent whiteness, appears only here and there between the foliage. It is difficult to imagine a more picturesque spot. It recalled forcibly to my remembrance the valleys of Derbyshire, and the cavernous mountains of Muggendorf, in Franconia. Instead of the beeches and maple trees of Europe we here find the statelier forms of the ceiba and the palm-tree, the praga and irasse. Numberless springs gush from the sides of the rocks which encircle the basin of Caripe, and of which the abrupt slopes present, towards the south, profiles of a thousand feet in height. These springs issue, for the most part, from a few narrow crevices. The humidity which they spread around favours the growth of the great trees; and the natives, who love solitary places, form their conucos along the sides of these crevices. Plantains and papaw trees are grouped together with groves of arborescent fern; and this mixture of wild and cultivated plants gives the place a peculiar charm. Springs are distinguished from afar, on the naked flanks of the mountains, by tufted masses of vegetation* which at first sight seem suspended from the rocks, and

[^81]descending into the valley, they follow. the sinuosities of the torrents.

We were received with great hospitality by the monks of Caripe. The building has an inner court, surrounded by an arcade, like the convents in Spain. This enclosed place was highly convenient for setting up our instruments and making observations. We found a numerous society in the convent. Young monks, recently arrived from Spain, were just about to settle in the Missions, while old infirm missionaries sought for health in the fresh and salubrious air of the mountains of Caripe. I was lodged in the cell of the superior, which contained a pretty good collection of books. I found there, to my surprise, the Teatro Critico of Feijoo, the Lettres Edifiantes, and the Traité d'Electricité by abbe Nollet. It seemed as if the progress of knowledge advanced even in the forests of America. The youngest of the capuchin monks of the last Mission had brought with him a Spanish translation of Chaptal's Treatise on Chemistry, and he intended to study this work in the solitude where he was destined to pass the remainder of his days. During our long abode in the Missions of South America we never perceived any sign of intolerance. The monks of Caripe were not ignorant that I was born in the protestant part of Germany. Furnished as I was with orders from the court of Spain, I had no motives to conceal from them this fact; nevertheless, no mark of distrust, no indiscreet question, no attempt at controversy, ever diminished the value of the hospitality they exercised with so much liberality and frankness.

The convent is founded on a spot which was anciently called Areocuar. Its height above the level of the sea is nearly the same as that of the town of Caracas, or of the inhabited part of the Blue Mountains of Jamaica. Thus the mean temperatures of these three points, all situated within the tropics, are nearly the same. The necessity of being well clothed at night, and especially at sunrise, is felt at Caripe. We saw the centigrade thermometer at midnight, between $16^{\circ}$ and $17.5^{\circ}$; in the morning, between $19^{\circ}$ and $20^{\circ}$. About one o'clock it had risen only to $21^{\circ}$, or $22.5^{\circ}$. This temperature is sufficient for the development of the productions of the torrid zone; though, com-

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pared with the excessive heat of the plains of Cumana, we might call it the temperature of spring. Water exposed to currents of air in vessels of porous clay, cools at Caripe, during the night, as low as $13^{\circ}$.

Experience has proved that the temperate climate and rarefied air of this spot are singularly favourable to the cultivation of the coffee-tree, which is well known to flourish on heights. The prefect of the capuchins, an active and enlightened man, has introduced into the province this new branch of agricultural industry. Indigo was formerly planted at Caripe, but the small quantity of fecula yielded by this plant, which requires great heat, caused the culture to be abandoned. We found in the conuco of the community many culinary plants, maize, sugar cane, and five thousand coffeetrees, which promised a fine harvest. The friars were in hopes of tripling the number in a few years. We cannot help remarking the uniform efforts for the cultivation of the soil which are manifested in the policy of the monastic hierarchy. Wherever convents have not yet acquired wealth in the New Continent, as formerly in Gaul, in Syria, and in the north of Europe, they exercise a happy influence on the clearing of the ground and the introduction of exotic vegetation. At Caripe, the conuco of the community presents the appearance of an extensive and beautiful garden. The natives are obliged to work in it every morning from six to ten, and the alcaldes and alguazils of Indian race overlook their labours. These men are looked upon as great state functionaries, and they alone have the right of carrying a cane. The selection of them depends on the superior of the convent. The pedantic and silent gravity of the Indian alcaldes, their cold and mysterious air, their love of appearing in form at church and in the assemblies of the people, force a smile from Europeans. We were not yet accustomed to these shades of the Indian character, which we found the same at the Orinoco, in Mexico, and in Peru, among people totally different in their manners and their language. The alcaldes came daily to the convent, less to treat with the monks on the affairs of the Mission, than under the pretence of inquiring after the health of the newly-arrived travellers. As we gave them brandy, their visits became more frequent than the monks desired.

That which confers most celebrity on the valley of Caripe; besides the extraordinary coolness of its climate, is the great Cueva, or Cavern of the Guacharo.* In a country where the people love the marvellous, a cavern which gives birth to a river, and is inhabited by thousands of nocturnal birds, the fat of which is employed in the Missions to dress food, is an everlasting object of conversation and discussion. The cavern, which the natives call "a mine of fat," is not in the valley of Caripe itself, but three short leagues distant from the convent, in the direction of west-south-west. It opens into a lateral valley, which terminates at the Sierra del Guacharo.

We set out for the Sierra on the 18th of September, accompanied by the alcaldes, or Indian magistrates, and the greater part of the monks of the convent. A narrow path led us at first towards the south, across a fine plain, covered with beautiful turf. We then turned westward, along the margin of a small river which issues from the mouth of the cavern. We ascended during three quarters of an hour, sometimes in the water, which was shallow, sometimes between the torrent and a wall of rocks, on a soil extremely slippery and miry. The falling down of the earth, the scattered trunks of trees, over which the mules could scarcely pass, and the creeping plants that covered the ground, rendered this part of the road fatiguing. We were surprised to find here, at scarcely 500 toises above the level of the sea, a crucifernus plant, Raphanus pinnatus. Plants of this family are very rare in the tropics; they have in some sort a northern character, and therefore we never expected to see one on the plain of Caripe at so inconsiderable an elevation. The northern character also appears in the Galium caripense, the Valeriana scandens, and a sanicle not unlike the $S$. marilandica.

At the foot of the lofty mountain of the Guacharo, we were

[^82]only four hundred paees from the cavern, without yet perceiving the entrance. The torrent runs in a crevice hollowed out by the waters, and we went on under a cornice, the projection of which prevented us from seeing the sky. The path winds in the direction of the river; and at the last turning we came suddenly before the immense opening of the grotto. The aspect of this spot is majestic, even to the eye of a traveller accustomed to the picturesque scenery of the higher Alps. I had before this seen the caverns of the peak of Derbyshire, where, lying down flat in a boat, we proceeded along a subterranean river, under an arch two feet high. I had visited the beautiful grotto of Treshemienshiz, in the Carpathian mountains, the caverns of the Hartz, and those of Franconia, which are vast cemeteries,* containing bones of tigers, hyænas, and bears, as large as our horses. Nature in every zone follows immutable laws in the distribation of rocks, in the form of mountains, and even in those changes which the exterior crust of our planet has undergone. So great a uniformity led me to believe that the aspect of the cavern of Caripe would differ little from what I had observed in my preceding travels. The reality far exceeded my expectations. If the configuration of the grottoes, the splendour of the stalactites, and all the phenomena of inorganic nature, present striking analogies, the majesty of equinoctial vegetation gives at the same time an individual character to the aperture of the cavern.

The Cueva del Guacharo is pierced in the vertical profile of a rock. The entrance is towards the south, and forms an arch eighty feet broad and seventy-two high. The rock which surmounts the grotto is covered with trees of gigantic height. The mammee-tree and the genipa, $\dagger$ with large and

[^83]shining leaves, raise their branches vertically towards the sky; whilst those of the courbaril and the erythrina form, as they extend, a thick canopy of verdure. Plants of the family of pothos, with succulent stems, oxalises, and orchider of a singular structure, ${ }^{*}$ rise in the driest clefts of the rocks; while creeping plants waving in the winds are interwoven in festoons before the opening of the cavern. We distinguished in these festoons a bignonia of a violet blue, the purple dolichos, and for the first time, that magnificent solandra, $\dagger$ which has an orange-coloured flower and a fleshy tube more than four inches long.

But this luxury of vegetation embellishes not only the external arch, it appears even in the vestibule of the - grotto. We saw with astonishment plantain-leaved heliconias eighteen feet high, the praga palm-tree, and arborescent arums, following the course of the river, even to those subterranean places. The vegetation continues in the cave of Caripe as in those deep crevices of the Andes, half-excluded from the light of day, and does not disappear till, penetrating into the interior, we advance thirty or forty paces from the entrance. We measured the way by means of a cord; and we went on about four hundred and thirty feet without being obliged to light our torches. Daylight penetrates far into this region, because the grotto forms but one single channel, keeping the same direction, from south-east to north-west. Where the light began to fail, we heard from afar the hoarse sounds of the nocturnal birds; sounds which the natives think belong exclusively to those subterraneous places.

The guacharo is of the size of our fowls. It has the mouth of the goat-suckers and procnias, and the port of those vultures whose crooked beaks are surrounded with stiff silky hairs. Suppressing, with M. Cuvier, the order of picæ, we must refer this extraordinary bird to the passeres, the genera of which are connected with each other by almost imperceptible transitions. It forms a new genus, very different from the goatsucker, in the loudness of its voice, in the vast strength of its beak (containing a double

[^84]tooth), and in its feet without the membranes which unite the anterior phalanges of the claws. It is the first example of a nocturnal bird among the Passeres dentirostrati. Its habits present analogies both with those of the goatsuckers and of the alpine crow.* The plumage of the guacharo is of a dark bluish grey, mixed with small streaks and specks of black. Large white spots of the form of a heart, and bordered with black, mark the head, wings, and tail. The eyes of the bird, which are dazzled by the light of day, are blue, and smaller than those of the goatsucker. The spread of the wings, which are composed of seventeen or eighteen quill feathers, is three feet and a half. The guacharo quits the cavern at nightfall, especially when the moon shines. It is almost the only frugiferous nocturnal bird yet known; the conformation of its feet sufficiently shows that it does not hunt like our owls. It feeds on very hard fruits, like the nutcracker $\dagger$ and the pyrrhocorax. The latter nestles also in clefts of rocks, and is known by the name of the night-crow. The Indians assured us that the guacharo does not pursue either the lamellicornous insects or those phalænæ which serve as food to the goatsuckers. A comparison of the beaks of the guacharo and the goatsucker serves to denote how much their habits must differ. It would be difficult to form an idea of the horrible noise occasioned by thousands of these birds in the dark part of the cavern. Their shrill and piercing cries strike upon the vaults of the rocks, and are repeated by the subterranean echoes. The Indians showed us the nests of the guacharos by fixing a torch to the end of a long pole. These nests were fifty or sixty feet high above our heads, in holes in the shape of funnels, with which the roof of the grotto is pierced like a sieve. The noise increased as we advanced, and the birds were scared by the light of the torches of copal. When this noise ceased a few minutes around us, we heard at a distance the plaintive cries of the birds roosting in other ramifications of the cavern. It seemed as if different groups answered each other alternately.

* Corvus Pyrrhocorax.
$\dagger$ Corvus caryocatactes, C. glandarius. Our Alpine crow builds its nest near the top of Mount Libanus, in subterranean caverns, nearly like the guacharo. It also has the horribly shrill cry of the latter.

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The Indisns enter the Caeva del Guacharo once a-year, near midsummer. They go armed with poles, with which they destroy the greater part of the nests. At that season several thousand birds are killed; and the old ones, as if to defend their brood, hover over the heads of the Indians, uttering terrible cries. The young,* which fall to the ground, are opened on the spot. Their peritoneum is found extremely loaded with fat, and a layer of fat reaches from the abdomen to the anus, forming a kind of cushion between the legs of the bird. This quantity of fat in frugivorous animals, not exposed to the light, and exerting very little muscular motion, reminds us of what has been observed in the fattening of geese and oxen. It is well known how greatly darkness and repose favour this process. The nocturnal birds of Europe are lean, because, instead of feeding on fruits, like the guacharo, they live on the scanty produce of their prey. At the period commonly called, at Caripe, the oil harvest, $\dagger$ the Indians build huts with palm-leaves, near the entrance, and even in the porch of the cavern. There, with a fire of brushwood, they melt in pots of clay the fat of the young birds just killed. This fat is known by the name of butter or oil (manteca, or aceite) of the guacharo. It is half liquid, transparent, without smell, and so pure that it may be kept above a year without becoming rancid. At the convent of Caripe no other oil is used in the kitchen of the monks but that of the cavern; and we never observed that it gave the aliments a disagreeable taste or smell.

The race of the guacharos would have beem long ago extinct, had not several circumstances contributed to its preservation. The natives, restrained by their superstitious ideas, seldom have courage to penetrate far into the grotto. It appears also, that birds of the same species dwell in neighbouring caverns, which are too narrow to be accessible to man. Perhaps the great cavern is repeopled by colonies which forsake the small grottoes; for the missionaries assured us, that hitherto no sensible diminution of the birds have been observed. Young guacharos have been sent to the port of Cumana, and have lived there several days without taking any nourishment, the seeds offered to them

* Called Los pollos del Guacharo. $\dagger$ La conecha de la manteca.
not suiting their taste. When the crops and gizzards of the young birds are opened in the cavern, they are found to contain all sorts of hard and dry fruits, which furnish, under the singular name of guacharo seed (semilla del guacharo), a very celebrated remedy against intermittent fevers. The old birds carry these seeds to their young. They are carefully collected, and sent to the sick at Cariaco, and other places of the low regions, where fevers are generally prevalent.

As we continued to advance into the cavern, we followed the banks of the small river which issues from it, and is from twenty-eight to thirty feet wide. We walked on the banks, as far as the hills formed of calcareous incrustations permitted us. Where the torrent winds among very high masses of stalactites, we were often obliged to descend into its bed, which is only two feet deep. We learned with surprise, that this subterranean rivulet is the origin of the river Caripe, which, at the distance of a few leagues, where it joins the small river of Santa Maria, is navigable for canoes. It flows into the river Areo under the name of Caño de Terezen. We found on the banks of the subterranean rivulet a great quantity of palm-tree wood, the remains of trunks, on which the Indians climb to reach the nests hanging from the roofs of the cavern. The rings, formed by the vestiges of the old footstalks of the leaves, furnish as it were the steps of a ladder perpendicularly placed.

The Grotto of Caripe preserves the same direction, the same breadth, and its primitive height of sixty or seventy feet, to the distance of 472 metres, or 1458 feet, accurately measured. We had great difficulty in persuading the Indians to pass beyond the anterior portion of the grotto, the only part which they annually visit to collect the fat. The whole authority of 'los padres' was necessary to induce them to advance as far as the spot where the soil rises abruptly at an inclination of sixty degrees, and where the torrent forms a small subterranean cascade.* The natives connect mystic ideas with this cave, inhabited by nocturnal birds; they believe that the souls of their ancestors sojourn in the deep

[^85]s 2
recesses of the cavern. "Man," say they, "should avoid places which are enlightened neither by the sun (zis), nor by the moon (nuna)." 'To go and join the guacharos,' is with them a phrase signifying to rejoin their fathers, to die. The magicians (piaches) and the poisoners (imorons) perform their nocturnal tricks at the entrance of the cavern, to conjure the chief of the evil spirits (ivorokiamo). Thus in every region of the earth a resemblance may be traced in the early fictions of nations, those especially which relate to two principles governing the world, the abode of souls after death, the happiness of the virtuous and the punishment of the guilty. The most different and most barbarous languages present a certain number of images, which are the same, because they have their source in the nature of our intelligence and our sensations. Darkness is everywhere connected with the idea of death. The Grotto of Caripe is the Tartarus of the Greeks; and the guacharos, which hover over the rivulet, uttering plaintive cries, remind us of the Stygian birds.

At the point where the river forms the subterranean cascade, a hill covered with vegetation, which is opposite to the opening of the grotto, presents a very picturesque aspect. It is seen at the extremity of a straight passage, 240 toises in length. The stalactites descending from the roof, and resembling columns suspended in the air, are relieved on a back-ground of verdure. The opening of the cavern appeared singularly contracted, when we saw it about the middle of the day, illumined by the vivid light reflected at once from the sky, the plants, and the rocks. The distant light of day formed a strange contrast with the darkness which surrounded us in the vast cavern. We discharged our guns at a venture, wherever the cries of the nocturnal birds and the flapping of their wings, led us to suspect that a great number of nests were crowded together. After several fruitless attempts M. Bonpland succeeded in killing a couple of guacharos, which, dazzled by the light of the torches, seemed to pursue us. This circumstance afforded me the means of making a drawing of this bird, which had previously been unknown to naturalists. We climbed, not without difficulty, the small hill whence the subterranean rivulet descends. We saw that the grotto was perceptibly
contracted, retaining only forty feet in height, and that it continued stretching to north-east, without deviating from its primitive direction, which is parallel to that of the great valley of Caripe.

In this part of the cavern, the rivulet deposits a blackish mould, very like the matter which, in the grotto of Muggendorf, in Franconia, is called "the earth of sacrifice."* We could not discover whether this fine and spongy mould falls through the cracks which communicate with the surface of the ground above, or is washed down by the rain-water penetrating into the cavern. It was a mixture of silex, alumina, and vegetable detritus. We walked in thick mud to a spot where we beheld with astonishment the progress of subterranean vegetation. The seeds which the birds carry into the grotto to feed their young, spring up wherever they fix in the mould which covers the calcareous incrustations. Blanched stalks, with some half-formed leaves, had risen to the height of two feet. It was impossible to ascertain the species of these plants, their form, colour, and aspect having been changed by the absence of light. These traces of organization amidst darkness forcibly excited the curiosity of the natives, who examined them with silent meditation inspired by a place they seemed to dread. They evidently regarded these subterranean plants, pale and deformed, as phantoms banished from the face of the earth. To me the scene recalled one of the happiest periods of my early youth, a long abode in the mines of Freyberg, where I made experiments on the effects of blanching (étiolement), which are very different, according as the air is pure or overcharged with hydrogen or azote.

The missionaries, with all their authority, could not prevail on the Indians to penetrate farther into the cavern. As the roof became lower the cries of the guacharos were more and more shrill. We were obliged to yield to the pusillanimity of our guides, and trace back our steps. The appearance of the cavern was however very uniform. We found that a bishop of St. Thomas of Guiana had gone farther than ourselves. He had measured nearly 2500 feet from the mouth

[^86]to the spot where he stopped, but the cavern extended atill farther. The remembrance of this fact was preserved in the convent of Caripe, without the exact period being noted. The bishop had provided himself with great torches of white Castile wax. We had torches composed only of the bark of trees and native resin. The thick smoke which issued from these torches, in a narrow subterranean passage, hurts the eyes and obstructs the respiration.

On turning back to go out of the cavern, we followed the course of the torrent. Before our eyes became dazzled with the light oí day we saw on the outside of the grotto the water of the river sparkling amid the foliage of the trees which shaded it. It was like a picture placed in the distance, the mouth of the cavern serving as a frame. Having at length reached the entrance, we seated ourselves on the bank of the rivulet, to rest after our fatigues. We were glad to be beyond the hoarse cries of the birds, and to leave a place where darkness does not offer even the charm of silence and tranquillity. We could scarcely persuade ourselves that the name of the Grotto of Caripe had hitherto been unknown in Europe;* for the guacharos alone might have sufficed to render it celebrated. These nocturnal birds have been no where yet discovered, except in the mountains of Caripe and Cumanacoa. The missionaries had prepared a repast at the entry of the cavern. Leaves of the banana and the vijao, $\dagger$ which have a silky lustre, served us as a table-cloth, according to the custom of the country. Nothing was wanting to our enjoyment, not even remembrances, which are so rare in those countries, where generations disappear without leaving a trace of their existence.

Before we quit the subterranean rivulet and the nocturnal birds, let us cast a last glance at the cavern of the Guacharo, and the whole of the physical phenomena it pre-

[^87]sents. When we have step by step pursued a long series of observations modified by the localities of a place, we love to stop and raise our views to general considerations. Do the great cavities, which are exclusively called caverns, owe their origin to the same causes as those which have produced the lodes of veins and of metalliferous strata, or the extraordinary phenomenon of the porosity of rocks? Do grottoes belong to every formation, or to that period only when organized beings began to people the surface of the globe? These geological questions can be solved only so far as they are directed by the actual state of things, that is, of facts susceptible of being verified by observation.

Considering rocks according to the succession of eras, we find that primitive formations exhibit very few caverns. The great cavities which are observed in the oldest granite, and which are called fours (ovens) in Switzerland and in the south of France, when they are lined with rock crystals, arise most frequently from the union of several contemporaneous veins of quartz,* of feldspar, or of fine-grained granite. The gneiss presents, though more seldom, the same phenomenon; and near Wunsiedel, $\dagger$ at the Fichtelgebirge, I had an opportunity of cxamining crystal fours of two or three feet diameter, in a part of the rock not traversed by veins. We are ignorant of the extent of the cavities which subterranean fires and volcanic agitations may have produced in the bowels of the earth in those primitive rocks, which, containing considerable quantities of amphibole, mica, garnet, magnetic iron-stone, and red schorl (titanite), appear to be anterior to granite. We find some fragments of these rocks among the matters ejected by volcanoes. The cavities can be considered only as partial and local phenomena; and their existence is scarcely any contradiction to the notions we have acquired from the experiments of Maskelyne and Cavendish on the mean density of the earth.

* Gleichzeitige Trümmer. To these stone veins which appear to be of the same age as the rock, belong the veins of talc and asbestos in serpentine, and those of quartz traversing schist (Thonschiefer). Jameson on Contemporaneous Veins, in the Mem. of the Wernerian Soc.
$\dagger$ In Franconia, south-east of Luchsburg.

In the primitive mountains open to our researches, real grottoes, those which have some extent, belong only to calcareous formations, such as the carbonate or sulphate of lime. The solubility of these substances appears to have favoured the action of the subterranean waters for ages. The primitive limestone presents spacious caverns as well as transition limestone,* and that which is exclusively called secondary. If these caverns be less frequent in the first, it is because this stone forms in general only layers subordinate to the mica-slate, $\dagger$ and not a particular system of mountains, into which the waters may filter, and circulate to great distances. The erosions occasioned by this element depend not only on its quantity, but also on the length of time during which it remains, the velocity it acquires by its fall, and the degree of solubility of the rock. I have observed in general, that the waters act more easily on the carbonates and the sulphates of lime of secondary mountains than on the transition limestones, which have a considerable mixture of silex and carbon. On examining the internal structure of the stalactites which line the walls of caverns, we find in them all the characters of a chemical precipitate.

As we approach those periods in which organic life developes itself in a greater number of forms, the phenomenon of grottoes becomes more frequent. There exist several under the name of baumen, $\ddagger$ not in the ancient sandstone to which the great coal formation belongs, but in the Alpine limestone, and in the Jura limestone, which is often only the superior part of the Alpine formation. The Jura limestone§ so abounds with

* In the primitive limestone are found the Kuetzel-loch, near Kaufungen in Silesia, and probably several caverns in the islands of the Archipelago. In the transition limestone we remark the caverns of Elbingerode, of Rubeland, and of Scharzfeld, in the Hartz; those of the Salzfluhe in the Grisons; and, according to Mr. Greenough, that of Torbay in Devonshire.
$\dagger$ Sometimes to gneiss, as at the Simplon, between Dovredo and Crevola.
$\ddagger$ In the dialect of the German Swiss, Balmen. The Baumen of the Sentis, of the Mole, and of the Beatenberg, on the borders of the lake of .Thun, belong to the Alpine limestone.
§ I may mention only the grottoes of Boudry, Motiers-Travers, and Valorbe, in the Jura; the grotto of Balme near Geneva; the caverns between Muggendorf and Gaylenreuth in Franconia; Sowia Jama, Ogrodzimiec, and Wlodowice, in Poland.
caverns in both continents, that several geologists of the school of Freyberg have given it the name of cavern-limestone (höhlenkalkstein). It is this rock which so often interrupts the course of rivers, by engulfing them into its bosom. In this also is formed the famous Cueva del Guacharo, and the other grottoes of the valley of Caripe. The muriatiferous gypsum,* whether it be found in layers in the Jura or Alpine limestone, or whether it separate these two formations, or lie between the Alpine limestone and argillaceous sandstone, also presents, on account of its great solubility, enormous cavities, sometimes communicating with each other at several leagues distance. After the limestone and gypseous formations, there would remain to be examined, among the secondary rocks, a third formation, that of the argillaceous sandstone, newer than the brine-spring formations; but this rock, composed of small grains of quartz cemented by clay, seldom contains caverns; and when it does, they are not extensive. Progressively narrowing towards their extremity, their walls are covered with a brown ochre.

We have just seen, that the form of grottoes depends partly on the nature of the rocks in which they are found ; but this form, modified by exterior agents, often varies even in the same formation. The configuration of caverns, like the outline of mountains, the sinuosity of valleys, and so many other phenomena, present at first sight only irregularity and confusion. The appearance of order is resumed, when we can extend our observations over a vast space of ground, which has undergone violent, but periodical and uniform revolutions. From what I have seen in the mountains of Europe, and in the Cordilleras of America, caverns may be divided, according to their interior structure, into three classes. Some have the form of large clefts or crevices, like veins not filled with ore; such as the cavern of Rosenmüller, in Franconia, Elden-hole, in the peak of Derbyshire, and the Sumideros of Chamacasapa in Mexico. Other caverns are open to the light at both ends. These are rocks really pierced; natural galleries, which run through a solitary mountain: such are the Höhleberg of Muggendorf, and the famous cavern called Dantoe by the

[^88]Ottomite Indians. and the Bridge of the Mother of God, by the Mexican Spaniards. It is difficult to decide respecting the origin of these channels, which sometimes serve as beds for subterranean rivers. Are these pierced rocks hollowed out by the impulse of a current? or should we rather admit that one of the openings of the cavern is owing to a falling down of the earth subsequent to its original formation; to a change in the external form of the mountain, for instance, to a new valley opened on its flank? A third form of caverns, and the most common of the whole, exhibits a succession of cavities, placed nearly on the same level, running in the same direction, and communicating with each other by passages of greater or less breadth.

To these differences of general form are added other circumstances not less remarkable. It often happens, that grottoes of little space have extremely wide openings; whilst we have to creep under very low vaults, in order to penetrate into the deepest and most spacious caverns. The passages which unite partial grottoes, are generally horizontal. I have seen some, however, which resemble funnels or wells, and which may be attributed to the escape of some elastic fluid through a mass before being hardened. When rivers issue from grottoes, they form only a single, horizontal, continuous channel, the dilatations of which are almost imperceptible; as in the Cueva del Guacharo we have just described, and the cavern of San Felipe, near Tehuilotepec in the western Cordilleras of Mexico. The sudden disappearance* of the river, which took its rise from this last cavern, has impoverished a district in which farmers and miners equally require water for refreshing the soil and for working hydraulic machinery.

Considering the variety of structure exhibited by grottoes in both hemispheres, we cannot but refer their formation to causes totally different. When we speak of the origin of caverns we must choose between two systems of natural philosophy: one of these systems attributes every thing to instantaneous and violent commotions (for example, to the elastic force of vapours, and to the heavings occasioned

[^89]by volcanoes) ; while the other rests on the operation of small powers, which produce effects almost insensibly by progressive action. Those who love to indulge in geological hypotheses must not, however, forget the horizontality so often remarked amidst gypseous and calcareous mountains, in the position of grottoes communicating with each other by passages. This almost perfect horizontality, this gentle and uniform slope, appears to be the result, of a long abode of the waters, which enlarge by erosion clefts already existing, and carry off the softer parts the more easily, as clay or muriate of soda is found mixed with the gypsum and fetid limestone. These effects are the same, whether the caverns form one long and continued range, or several of these ranges lie one over another, as happens almost exclusively in gypseous mountains.

That which in shelly or Neptunean rocks is caused by the action of the waters, appears sometimes to be in the volcanic rocks the effect of gaseous emanations* acting in the direction where they find the least resistance. When melted matter moves on a very gentle slope, the great axis of the cavity formed by the elastic fluids is nearly horizontal, or parallel to the plane on which the movement of transition takes place. A similar disengagement of vapours, joined to the elastic force of the gases, which penetrate strata softened and raised up, appears sometimes to have given great extent to the caverns found in trachytes or trappean porphyries. These porphyritic caverns, in the Cordilleras of Quito and Peru, bear the Indian name of Machays. $\dagger$ They are in general of little depth. They are lined with sulphur, and differ by the enormous size of their openings from those observed in volcanic tufas $\ddagger$ in Italy, at Teneriffe, and in

[^90]the Andes. It is by connecting in the mind the primitive, secondary, and volcanic rocks, and distinguishing between the oxidated crust of the globe, and the interior nucleus, composed perhaps of metallic and inflammable substances, that we may account for the existence of grottoes everywhere. They act in the economy of nature as vast reservoirs of water and of elastic fluids.

The gypseous caverns glitter with crystallized selenites. Vitreous crystallized plates of brown and yellow stand out on a striated ground composed of layers of alabaster and fetid limestone. The calcareous grottoes have a more uniform tint. They are more beautiful, and richer in stalactites, in proportion as they are narrower, and the circulation of air is less free. By being spacious, and accessible to air, the cavern of Caripe is almost destitute of those incrustations, the imitative forms of which are in other countries objects of popular curiosity. I also sought in vain for subterranean plants, those cryptogamia of the family of the Usneaceæ, which we sometimes find fixed on the stalactites, like ivy on walls, when we penetrate for the first time into a lateral grotto.*

The caverns in mountains of gypsum often contain mephitic emanations and deleterious gases. It is not the sulphate of lime that acts on the atmospheric air, but the clay slightly mixed with carbon, and the fetid limestone, so often mingled with the gypsum. We cannot yet decide, whether the swinestone acts as a hydrosulphuret, or by means of a bituminous principle. $\dagger$ Its property of absorbing oxygen gas is known to all the miners of Thuringia. It is the same as the action of the carburetted clay of the

[^91]gypseous grottoes, and of the great chambers (sinkwerke) dug in mines of fossil salt which are worked by the introduction of fresh water. The caverns of calcareous mountains are not exposed to those decompositions of the atmospheric air, unless they contain bones of quadrupeds, or the mould mixed with animal gluten and phosphate of lime, from which arise inflammable and fetid gases.

Though we made many enquiries among the inhabitants of Caripe, Cumanacoa, and Cariaco, we did not learn that they had ever discovered in the cavern of Guacharo either the remains of carniverous animals, or those bony breccias of herbivorous animals, which are found in the caverns of Germany and Hungary, and in the clefts of the calcareous rocks of Gibraltar. The fossil bones of the megatherium, of the elephant, and of the mastodon, which travellers have brought from South America, have all been found in the light soil of the valleys and table-lands. Excepting the megalonyx,* a kind of sloth of the size of an ox, described by Mr. Jefferson, I know not a single instance of the skeleton of an animal buried in a cavern of the New World. The extreme scarcity of this geological phenomenon will appear the less surprising to us, if we recollect, that in France, England, and Italy, there are also a great number of grottoes in which we have never met with any vestige of fossil bones.

Although, in primitive nature, whatever relates to ideas of extent and mass is of no great importance, yet I may observe, that the cavern of Caripe is one of the most spacious known to exist in limestone formations. It is at least 900 metres or 2800 feet in length. $\dagger$ Owing to the different degrees of solubility in rocks, it is generally not in calcareous mountains, but in gypseous formations, that we find the most extensive succession of grottoes. In Saxony there are some in gypsum several leagues in length;

[^92]for instance, that of Wimelburg, which communicates with the cavern of Cresfield.

The determination of the temperature of grottoes presents a field for interesting observation. The cavern of Caripe', situated nearly in the latitude of $10^{\circ} 10^{\prime}$, consequently in the centre of the torrid zone, is elevated 506 toises above the level of the sea in the gulf of Cariaco. We found that, in every part of it, in the month of September, the temperature of the internal air was between $18 \cdot 4^{\circ}$ and $18.9^{\circ}$ of the centesimal thermometer ; the external atmosphere being at $16.2^{\circ}$. At the entrance of the cavern, the thermometer in the open air was at $17.6^{\circ}$; but when immersed in the water of the little subterranean river, it marked, even to the end of the cavern, $16.8^{\circ}$. These experiments are very interesting, if we reflect on the tendency to equilibrium of heat, in the waters, the air, and the earth. When I left Europe, men of science were regretting that they had not sufficient data on what is called, 'the temperature of the interior of the globe;' and it is but very recently that efforts have been made, and with some success, to solve the grand problem of subterranean meteorology. The stony strata that form the crust of our planet, are alone accessible to our examination; and we now know that the mean temperature of these strata. varies not only with latitudes and heights, but that, according to the position of the several places, it performs also, in the space of a year, regular oscillations round the mean heat of the neigbouring atmosphere. The time is gone by when men were surprised to find, in other zones, the heat of grottoes and wells differing from that observed in the caves of the observatory at Paris. The same instrument which in those caves marks $12^{\circ}$, rises in the subterraneous caverns of the island of Madeira, near Funchal, to $16.2^{\circ}$; in Joseph's Well, at Cairo* to $21.2^{\circ}$; in the grottoes of the island of Cuba to $22^{\circ}$ or $23^{\circ} . \dagger$ This increase is nearly in proportion to that of the mean temperature of the atmosphere, from latitude $48^{\circ}$ to the tropics.

[^93]We have just seen that, in the Cueva del Guacharo, the water of the river is nearly $2^{\circ}$ colder than the ambient air of the cavern. The water, whether in filtering through the rocks, or in running over stony beds, doubtless imbibes the temperature of these beds. The air contained in the grotto, on the contrary, is not in repose; it communicates with the external atmosphere. Though under the torrid zone, the changes of the external temperature are exceedingly trifling, currents are formed, which modify periodically the internal air. It is consequently the temperature of the waters, that of $16.8^{\circ}$, which we. might look upon as the temperature of the earth in those mountains, if we were sure that the waters do not descend rapidly from more elevated neighbouring mountains.

It follows from these observations, that when we cannot obtain results perfectly exact, we find at least under each zone certain numbers which indicate the maximum and minimum. At Caripe, in the equinoctial zone, at an elevation of 500 toises, the mean temperature of the globe is not below $16.8^{\circ}$, which was the degree indicated by the water of the subterranean river. We can even prove that this temperature of the globe is not above $19^{\circ}$, since the air of the cavern, in the month of September, was found to be at $18.7^{\circ}$. As the mean temperature of the atmosphere, in the hottest month, does not exceed $19 \cdot 5^{\circ}, *$ it is probable that a thermometer in the grotto would not rise higher than $19^{\circ}$ at any season of the year.

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## Chapter VIII.

Departure from Caripe.-Mountain and Forest of Santa Maria.-Mission of Catuaro.-Port of Cariaco.

The days we passed at the Capuchin convent in the mountains of Caripe, glided swiftly away, though our manner of living was simple and uniform. From sunrise to nightfall we traversed the forests and neighbouring mountains, to collect plants. When the winter rains prevented us from undertaking distant excursions, we visited the huts of the Indians, the conuco of the community, or those assemblies in which the alcaldes every evening arrange the labours of the succeeding day. We returned to the monastery only when the sound of the bell called us to the refectory to share the repasts of the missionaries. Sometimes, very early in the morning, we followed them to the church, to attend the doctrina, that is to say, the religious instruction of the Indians. It was rather a difficult task to explain dogmas to the neophytes, especially those who had but a very imperfect knowledge of the Spanish language. On the other hand, the monks are as yet almost totally ignorant of the language of the Chaymas; and the resemblance of sounds confuses the poor Indians and suggests to them the most whimsical ideas. Of this I may cite an example. I saw a missionary labouring earnestly to prove that infierno, hell, and invierno, winter, were not one and the same thing; but as different as heat and cold. The Chaymas are acquainted with no other winter than the season of rains; and consequently they imagined the 'Hell of the whites' to be a place where the wicked are exposed to frequent showers. The missionary harangued to no purpose: it was impossible to efface the first impression produced by the analogy between the two consonants. He could not separate in the minds of the neophytes the ideas of rain and hell; invierno and infierno.

After passing almost the whole day in the open air, we employed our evenings, at the convent, in making notes,
drying our plants, and sketching those that appeared to form new genera. Unfortunately the misty atmosphere of a valley, where the surrounding forests fill the air with an enormous quantity of vapour, was unfavourable to astronomical observations. I spent a part of the nights waiting to take advantage of the moment when some star should be visible between the clouds, near its passage over the meridian. I often shivered with cold, though the thermometer only sunk to $16^{\circ}$, which is the temperature of the day in our climates towards the end of September. The instruments remained set up in the court of the convent for several hours, yet I was almost always disappointed in my expectations. Some good observations of Fomalhaut and of Deneb have given $10^{\circ} 10^{\prime} 14^{\prime \prime}$ as the latitude of Caripe; which proves that the position indicated in the maps of Caulin is $18^{\prime}$ wrong, and in that of Arrowsmith 14'.

Observations of corresponding altitudes of the sun having given me the true time, within about $2^{\prime \prime}$, I was enabled to determine the magnetic variation with precision, at noon. It was, on the 20th of September, 1799, $3^{\circ} 15^{\prime} 30^{\prime \prime}$ north-east; consequently $0^{\circ} 58^{\prime} 15^{\prime \prime}$ less than at Cumana. If we attend to the influence of the horary variations, which in these countries do not in general exceed $8^{\prime}$, we shall find, that at considerable distances the variation changes less rapidly than is usually supposed. The dip of the needle was $42.75^{\circ}$, centesimal division, and the number of oscillations, expressing the intensity of the magnetic forces, rose to 229 in ten minutes.

The vexation of seeing the stars disappear in a misty sky was the only disappointment we felt in the valley of Caripe. The aspect of this spot presents a character at once wild and tranquil, gloomy and attractive. In the solitude of these mountains we are perhaps less struck by the new impressions we receive at every step, than with the marks of resemblance we trace in climates the most remote from each other. The hills by which the convent is backed, are crowned with palmtrees and arborescent ferns. In the evenings, when the sky denotes rain, the air resounds with the monotonous howling of the alouate apes, which resembles the distant sound of wind when it shakes the forest. Yet amid these strange sounds, these wild forms of plants, and these prodigies of a new world, nature everywhere speaks to man in a voice vOL. I. •

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familiar to him. The turf that overspreads the soil ; the old moss and fern that cover the roots of the trees; the torrents that gush down the sloping banks of the calcareous rocks; in fine, the harmonious accordance of tints reflected by the waters, the verdure, and the sky; everything recalls to the traveller, sensations which he has already felt.

The beauties of this mountain scenery so much engaged us, that we were very tardy in observing the embarrassment felt by our kind entertainers the monks. They had but a slender provision of wine and wheaten bread; and although in those high regions both are considered as belonging merely to the luxuries of the table, yet we saw with regret, that our hosts abstained from them on our account. Our portion of bread had already been diminished three-fourths, yet violent rains still obliged us to delay our departure for two days. How long did this delay appear! It made us dread the sound of the bell that summoned us to the refectory.

We departed at length on the 22nd of September, followed by four mules, laden with our instruments and plants. We had to descend the north-east slope of the calcareous Alps of New Andalusia, which we have called the great chain of the Brigantine and the Cocollar. The mean elevation of this chain scarcely exceeds six or seven hundred toises : in respect to height and geological constitution, we may compare it to the chain of the Jura. Notwithstanding the inconsiderable elevation of the mountains of Cumana, the descent is extremely difficult and dangerous in the direction of Cariaco. The Cerro of Santa Maria, which the missionaries ascend in their journey from Cumana to their convent at Caripe, is famous for the difficultios it presents to travellers. On comparing these mountains with the Andes of Peru, the Pyrenees, and the Alps, which we successively visited, it has more than once occurred to us, that the less lofty summits are sometimes the most inaccessible.

On leaving the valley of Caripe, we first crossed a ridge of hills north-east of the convent. The road led us along a continual ascent through a vast savannah, as far as the table-land of Guardia de San Augustin. We there halted to wait for the Indian who carried the barometer. We found ourselves to be at 533 toises of absolute elevation, or a little higher than the bottom of the cavern of Guacharo. The savannahs
or natural meadows, which yield excellent pasture for the cows of the convent, are totally devoid of trees or shrubs. It is the domain of the monocotyledonous plants; for amidst the gramina only a few Maguey* plants rise here and there; their flowery stalks being more than twenty-six feet high. Having reached the table-land of Guardia, we appeared to be transported to the bed of an old lake, levelled by the longcontinued abode of the waters. We seemed to trace the sinuosities of the ancient shore in the tongues of land which jut out from the craggy rock, and even in the distribution or the vegetation. The bottom of the basin is a savannah, while its banks are covered with trees of full growth. This is probably the most elevated valley in the provinces of Venezuela and Cumana. One cannot but regret, that a spot favoured by so temperate a climate, and which without doubt would be fit for the culture of corn, is totally uninhabited.

From the table-land of Guardia we continued to descend, till we reached the Indian village of Santa Cruz. We passed at first along a slope extremely slippery and steep, to which the missionaries had given the name of Baxada del Purgatorio, or Descent of Purgatory. It is a rock of schistose sandstone, decomposed, covered with clay, the talus of which appears frightfully steep, from the effect of a very common optical illusion. When we look down from the top to the bottom of the hill the road seems inclined more than $60^{\circ}$ : The mules in going down draw their hind legs near to their fore legs, and lowering their cruppers, let themselves slide at a venture. The rider runs no risk, provided he slacken the bridle, thereby leaving the animal quite free in his movements. From this point we perceived towards the left the great pyramid of Guacharo. The appearance of this calcareous peak is very picturesque, but we soon lost sight of it, on entering the thick forest, known by the name of the Montaña de Santa Maria. We descended without intermission for seven hours. It is difficult to conceive a more tremendous descent; it is absolutely a road of steps, a kind of ravine, in which, during the rainy season, impetuous torrents dash from rock to rock. The steps are from two to three feet high, and the beasts of burden, after measuring with their eyes the space necessary to let their load pass between
the trunks of the trees, leap from one rock to another. Afraid of missing their mark, we saw them stop a few minutes to scan the ground, and bring together their four feet like wild goats. If the animal does not reach the nearest block of stone, he sinks half his depth into the soft ochreous clay, that fills up the interstices of the rock. When the blocks are wanting, enormous roots serve as supports for the feet of men and beasts. Some of these roots are twenty inches thick, and they often branch out from the trunks of the trees much above the level of the soil. The Creoles have sufficient confidence in the address and instinct of the mules, to remain in their saddles during this long and dangerous descent. Fearing fatigue less than they did, and being accustomed to travel slowly for the purpose of gathering plants and examining the nature of the rocks, we preferred going down on foot; and, indeed, the care which our chronometers demanded, left us no liberty of choice.

The forest that covers the steep flank of the mountain of Santa Maria, is one of the thickest I ever saw. The trees are of stupendous height and size. Under their bushy, deep green foliage, there reigns continually a kind of dim daylight, a peculiar sort of obscurity, of which our forests of pines, oaks, and beech-trees, convey no idea. Notwithstanding its elevated temperature, it is difficult to believe that the air can dissolve the quantity of water exhaled from the surface of the soil, the foliage of the trees, and their trunks : the latter are covered with a drapery of orchidex, peperomia, and other succulent plants. With the aromatic odour of the flowers, the fruit, and even the wood, is mingled that which we perceive in autumn in misty weather. Here, as in the forests of the Orinoco, fixing our eyes on the top of the trees, we discerned streams of vapour, whenever a solar ray penetrated, and traversed the dense atmosphere. Our guides pointed out to us among those majestic trees, the height of which exceeded 120 or 130 feet, the curucay of Terecen. It yields a whitish liquid, and very odoriferous resin, which was formerly employed by the Cumanagoto and Tagiri Indians, to perfume their idols. The young branches have an agreeable taste, though somewhat astringent. Next to the curucay and enormous trunks of hymenæa, (the diameter of which was more than nine or ten feet), the trees which
most excited our attention were the dragon's blood (Croton sanguifluum), the purple-brown juice of which flows down a whitish bark; the calahuala fern, different from that of Peru, but almost equally medicinal;* and the palm-trees, irasse, macanilla, corozo, and praga. $\dagger$ The last yields a very savoury palm-cabbage, which we had sometimes eaten at the convent of Caripe. These palms with pinnated and thorny leaves formed a pleasing contrast to the fern-trees. One of the latter, the Cyathea speciosa, $\ddagger$ grows to the height of more than thirty-five feet, a prodigious size for plants of this family. We discovered here, and in the valley of Caripe, five new kinds of arborescent ferns.§ In the time of Linnæus, botanists knew no more than four on both continents.

We observed that the fern-trees are in general much more rare than the palm-trees. Nature has confined them to temperate, moist, and shady places. They shun the direct rays of the sun, and while the pumos, the corypha of the steppes and other palms of America, flourish on the barren and burning plains, these ferns with arborescent trunks, which at a distance look like palm-trees, preserve the character and habits of cryptogamous plants. They love solitary places, little light, moist, temperate and stagnant air. If they sometimes descend towards the sea-coast, it is only under cover of a thick shade. The old trunks of the cyathea and the meniscium are covered with a carbonaceous powder, which, probably being deprived of hydrogen, has a metallic lustre like plumbàgo. No other plant presents this pheno-

* The calahuala of Caripe is the Polypodium crassifolium; that of Peru, the use of which has been so much extended by Messrs. Ruiz and Pavon, comes from the Aspidium coriaceum, Willd. (Tectaria calahuala, Cav.) In commerce the diaphoretic roots of the Polypodium crassifolium, and of the Acrostichum huascaro, are mixed with those of the calahuala or Aspidium coriaceum.
$\dagger$ Aiphanes praga.
$\ddagger$ Possibly a hemitelia of Robert Brown. The trunk alone is from 22 to 24 feet long. This and the Cyathea excelsa of the Mauritius, are the most majestic of all the fern-trees described by botanists. The total number of these gigantic cryptogamous plants amounts at present to 25 species, that of the palm-trees to 80 . With the cyathea grow, on the mountain of Santa Maria, Rhexia juniperina, Chiococca racemosa, and Commelina spicata.
§ Meniscium arborescens, Aspidium caducum, A. rostratum, Cyathea villosa, and C. speciosa.
menon ; for the trunks of the dicotyledons, in spite of the heat of the climate, and the intensity of the light, are less burnt within the tropics than in the temperate zone. It may be said that the trunks of the ferns, which, like the monocotyledons, are enlarged by the remains of the petioles, decay from the circumference to the centre; and that, deprived of the cortical organs through which the elaborated juices descend to the roots, they are burnt more easily by the action of the oxygen of the atmosphere. I brought to Earope some powders with metallic lustre, taken from very old trunks of Meniscium and Aspidium.

In proportion as we descended the mountain of Santa Maria, we saw the arborescent ferns diminish, and the number of palm-trees increase. The beautiful large-winged butterflies (nymphales), which fly at a prodigious height, became more common. Everything denoted our approach to the coast, and to a zone in which the mean temperature of the day is from 28 to 30 degrees.

The weather was cloudy, and led us to fear one of those heavy rains, during which from 1 to 1.3 inch of water sometimes falls in a day. The sun at times illumined the tops of the trees; and, though sheltered from its rays, we felt an oppressive heat. Thunder rolled at a distance; the clouds seemed suspended on the top of the lofty mountains of the Guacharo; and the plaintive howling of the araguatoes, which we had so often heard at Caripe, denoted the proximity of the storm. We now for the first time had a near view of these howling apes. They are of the family of the alouates,* the different species of which have long been confounded one with another. The small sapajous of America, which imitate in whistling the tones of the passeres, have the bone of the tongue thin and simple, but the apes of large size, as the alouates and marimondes, $\dagger$ have the tongue placed on a large bony drum. Their superior larynx has six pouches, in which the voice loses itself; and two of which, shaped like pigeons' nests, resemble the inferior larynx of birds. The air driven with force into the bony drum produces that mournful sound which characterises the araguatoes. I sketched on the spot these organs, which are imper-

[^95]fectly known to anatomists, and published the description of them on my return to Europe.

The araguato, which the Tamanac Indians call aravata,* and the Maypures marave, resembles a young bear. $\dagger$ It is three feet long, reckoning from the top of the head (which is small and very pyramidal) to the beginning of the prehensile tail. Its fur is bushy, and of a reddish brown; the breast and belly are covered with fine hair, and not bare as in the mono colorado, or alouate roux of Buffon, which we carefully examined in going from Carthagena to Santa Fé de Bogota. The face of the araguato is of a blackish blue, and is covered with a fine and wrinkled skin: its beard is pretty long; and, notwithstanding the direction of the facial line, the angle of which is only thirty degrees, the araguato has, in the expression of the countenance, as much resemblance to man as the marimonde (S. belzebuth, Bresson) and the capuchin of the Orinoco (S. chiropotes). Among thousands of araguatoes which we observed in the provinces of Cumana, Caracas, and Guiana, we never saw any change in the reddish brown fur of the back and shoulders, whether we examined individuals or whole troops. It appeared to me in general, that variety of colour is less frequent among monkeys than naturalists suppose.

The araguato of Caripe is a new species of the genus Stentor, which I have above described. It differs equally from the ouarine (S. guariba) and the alouate roux (S..seniculus, old man of the woods). Its eye, voice, and gait, denote melancholy. I have seen young araguatoes brought up in Indian huts. They never play like the little sagoins, and their gravity was described with much simplicity by Lopez de Gomara, in the beginning of the sixteenth century. "The Aranata de los Cumaneses," says this author, "has

[^96]the face of a man, the beard of a goat, and a grave demeanor (honrado gesto.)" Monkeys are more melancholy in proportion as they have more resemblance to man. Their sprightliness diminishes, as their intellectual faculties appear to increase.

We stopped to observe some howling monkeys, which, to the number of thirty or forty, crossed the road, passing in a file from one tree to another over the horizontal and intersecting branches. While we were observing their movements, we saw a troop of Indians going towards the mountains of Caripe. They were without clothing, as the natives of this country generally are. The women, laden with rather heavy burdens, closed the march. The men were all armed; and even the youngest boys had bows and arrows. They moved on in silence, with their eyes fixed on the ground. We endeavoured to learn from them whether we were yet far from the Mission of Santa Cruz, where we intended passing the night. We were overcome with fatigue, and suffered from thirst. The heat increased as the storm drew near, and we had not met with a single spring on the way. The words si, patre; no, patre; which the Indians continually repeated, led us to think they understood a little Spanish. In the eyes of a native every white man is a monk, a padre; for in the Missions the colour of the skin characterizes the monk, more than the colour of the garment. In vain we questioned them respecting the length of the way: they answered, as if by chance, si and no, without our being able to attach any precise sense to their replies. This made us the more impatient, as their smiles and gestures indicated their wish to direct us; and the forest seemed at every step to become thicker and thicker. At length we separated from the Indians; our guides were able to follow us only at a distance, because the beasts of burden fell at every step in the ravines.

After journeying for several hours, continually descending on blocks of scattered rock, we found ourselves unexpectedly at the outlet of the forest of Santa Maria. A savannah, the verdure of which had been renewed by the winter rains, stretched before us farther than the eye could reach. On the left we discovered a narrow valley, extending as far as the mountains of the Guacharo, and covered with a
thick forest. Looking downward, the eye rested on the tops of the trees, which, at eight hundred feet below the road, formed a carpet of verdure of a dark and uniform tint. The openings in the forest appeared like vast funnels, in which we could distinguish by their elegant forms and pinnated leaves, the Praga and Irasse palms. But what renders this spot eminently picturesque, is the aspect of the Sterra del Guacharo. Its northern slope, in the direction of the gulf of Cariaco, is abrupt. It presents a wall of rock, an almost vertical profile, exceeding 3000 feet in height. The vegetation which covers this wall is so scanty, that the eye can follow the lines of the calcareous strata. The summit of the Sierra is flat, and it is only at its eastern extremity, that the majestic peak of the Guacharo rises like an inclined pyramid. lits form resembles that of the needles and horns* of the Alps.

The savannah we crossed to the Indian village of Santa Cruz is composed of several smooth plateaux, lying above' each other like terraces. This geological phenomenon, which is repeated in every climate, seems to indicate a long abode of the waters in basins that have poured them from one to the other. The calcareous rock is no longer visible, but is sovered with a thick layer of mould. The last time we saw it in the forest of Santa Maria it was slightly porous, and looked more like the limestone of Cumanacoa than that of Caripe. We there found brown iron-ore disseminated in patches, and if we were not deceived in our observation, a Cornu-ammonis, which we could not succeed in our attempt to detach. It was seven inches indiameter. This fact is the more important, as in this part of America we have never seen ammonites. The Mission of Santa Cruz is situated in the midst of the plain. We reached it towards the evening, suffering much from thirst, having travelled nearly eight hours without finding water. The thermometer kept at $26^{\circ}$; accordingly we were not more than 190 toises above the level of the sea.

We passed the night in one of those ajupas called King's houses, which, as I have already said, serve as tambos or caravanserais to travellers. The rains prevented any observations of the stars; and the next day, the 23 rd of Sep-
*The Shreckhorner, the Finsteraarhorn, 8cc.
tember, we continued our descent towards the gulf of Cariaco. Beyond Santa Cruz a thick forest again appears; and in it we found, under tufts of melastomas, a beautiful fern, with osmundia leaves, which forms a new genus of the order of polypodiaceous plants.*

Having reached the mission of Catuaro, we were desirous of continuing our journey eastward by Santa Rosalia, Casanay, San Josef, Carupano, Rio Carives, and the Montaña of Paria; but we learnt with great regret, that torrents of rain had rendered the roads impassable, and that we should run the risk of losing the plants we had already gathered. A rich planter of cacao-trees was to accompany us from Sainta Rosalia to the port of Carupano ; but when the time of departure approached, we were informed that his affairs had called him to Cumana. We resolved in consequence to embark at Cariaco, and to return directly by the gulf, instead of passing between the island of Margareta and the isthmus of Araya. The Mission of Catuaro is situated on a very wild spot. Trees of full growth still surround the church, and the tigers come by night to devour the poultry and swine belonging to the Indians. We lodged at the dwelling of the priest, a monk of the congregation of the Observance, to whom the Capuchins had confided the Mission, because priests of their own community were wanting.

At this Mission we met Don Alexandro Mexia, the corregidor of the district, an amiable and well-educated man. He gave us three Indians, who, armed with their machetes, were to precede us, and cut our way through the forest. In this country, so little frequented, the power of vegetation is such at the period of the great rains, that a man on horseback can with difficulty make his way through narrow paths, covered with lianas and intertwining branches. To our great annoyance, the missionary of Catuaro insisted on conducting us to Cariaco ; and we could not decline the proposal. The movement for independence, which had nearly broken out at Caracas in 1798, had been preceded and followed by great agitation among the slaves at Coro, Maracaibo, and Caraico. At the last of these places an unfortunate negro had been condemned to die, and our host, the vicar of Catuaro, was going thither to offer him spiritual comfort. During

[^97]our journey we could not escape conversations, in which the missionary pertinaciously insisted on the necessity of the slave-trade, on the innate wickedness of the blacks, and the benefit they derived from their state of slavery among the Christians! The mildness of Spanish legislation, compared with the Black Code of most other nations that have possessions in either of the Indies, cannot be denied. But such is the state of the negroes, that justice, far from efficaciously protecting them during their lives, cannot even punish acts of barbarity which cause their death.

The road we took across the forest of Catuaro resembled the descent of the mountain Santa Maria; here also, the most difficult and dangerous places have fanciful names. We walked as in a narrow furrow, scooped out by torrents, and filled with fine tenacious clay. The mules lowered their cruppers and slid down the steepest slopes. This descent is called Saca Manteca.* There is no danger in the descent, owing to the great address of the mules of this country. The clay, which renders the soil so slippery, is produced by the numerous layers of sandstone and schistose clay crossing the bluish grey alpine limestone. This last disappears as we draw nearer to Cariaco. When we reached the mountain of Meapira, we found it formed in great part of a white limestone, filled with fossil remains, and from the grains of quartz agglutinated in the mass, it appeared to belong to the great formation of the sea-coast breccias. We descended this mountain on the strata of the rock, the section of which forms steps of unequal height. Farther on, going out of the forest, we reached the hill of 'Buenavista, $\dagger$ well deserving the name it bears; since it commands a view of the town of Cariaco, situated in the midst of a vast plain filled with plantations, huts, and scattered groups of cocoa-palms. To the west of Cariaco extends the wide gulf, which a wall of rock separates from the ocean : and towards the east are seen, like bluish clouds, the high mountains of Paria and Areo. This is one of the most extensive and magnificent prospects that can be enjoyed on the coast of New Andalusia. In the town of Cariaco we found a great

[^98]part of the inhabitants suffering from intermittent fever; a disease which in autumn assumes a formidable character. When we consider the extreme fertility of the surrounding plains, their moisture, and the mass of vegetation with which they are covered, we may easily conceive why, amidst so much decomposition of organic matter, the inhabitants do not enjoy that salubrity of air which characterizes the climate of Cumana.

The chain of calcareous mountains of the Brigantine and the Cocollar sends off a considerable branch to the north, which joins the primitive mountains of the coast. This branch bears the name of Sierra de Meapire; but towards the town of Cariaco it is called Cerro Grande de Curiaco. Its mean height did not appear to be more than 150 or 200 toises. It was composed, where I could examine it, of the calcareous breccias of the sea-coast. Marly and calcareous beds alternate with other beds containing grains of quartz. It is a very striking phenomenon for those who study the physical aspect of a country, to see a transverse ridge connect at right angles two parallel ridges, of which one, the more southern, is composed of secondary rocks, and the other, the more northern, of primitive rocks. The latter presents, nearly as far as the meridian of Carupano, only mica-slates but to the east of this point, where it communicates by a transverse ridge (the Sierra de Meapire) with the limestone range, it contains lamellar gypsum, compact limestoue, and other rocks of secondary formation. It might be supposed that the southern ridge has transferred these rocks to the northern chain.

When standing on the summit of the Cerro del Meapire, we see the mountain currents flow on one side to the gulf of Paria, and on the other to the gulf of Cariaco. East and west of the ridge there are low and marshy grounds, spreading out without interruption; and if it be admitted that both gulfs owe their origin to the sinking of the earth, and to rents caused by earthquakes, we must suppose that the Cerro de Meapire has resisted the convulsive movements of the globe, and hindered the waters of the gulf of Paria from uniting with those of the gulf of Cariaco. But for this rocky dyke, the isthmus itself in all probability would nave had no existence; and from the castle of Araya as far as

Cape Paria, the whole mass of the mountains of the coast would have formed a narrow island, parallel to the island of Santa Margareta, and four times as long. Not only do the inspection of the ground, and considerations deduced from its relievo, confirm these opinions; but a mere glance of the configuration of the coasts, and a geological map of the country, would suggest the same ideas. It would appear that the island of Margareta has been heretofore attached to the coast-chain of Araya by the peninsula of Chacopata and the Caribbee islands, Lobo and Coche, in the same manner as this chain is still connected with that of the Cocollar and Caripe by the ridge of Meapire.

At present we perceive that the humid plains which stretch east and west of the ridge, and which are improperly called the valleys San Bonifacio and Cariaco, are enlarging by gaining on the sea. The waters are receding, and these changes of the shore are very remarkable, more particularly on the coast of Cumana. If the level of the soil seem to indicate that the two gulfs of Cariaco and Paria formerly occupied a much more considerable space, we cannot doubt that at present the land is progressively extending. Near Cumana, a battery, called La Boca, was built in 1791 on the very margin of the sea; in 1799 we saw it very far inland. At the mouth of the Rio Neveri, near the Morro of Nueva Barcelona, the retreat of the waters is still more rapid. This local phenomenon is probably assignable to accumulations of sand, the progress of which has not yet been sufficiently examined. Descending the Sierra de Meapire, which forms the isthmus between the plains of San Bonifacio and Cariaco, we find towards the east the great lake of Putacuan, which communicates with the river Areo, and is four or five leagues in diameter. The mountainous lands that surround this basin are known only to the natives. There are found those great boa serpents known to the Chayma Indians by the name of guainas, and to which they fabulously attribute a sting under the tail. Descending the Sierra de Meapire to the west, we find at first a hollow ground (tierra hueca) which, during the great earthquakes of 1766, threw out asphaltum enveloped in viscous petroleum. Farther on, a numberless quantity of sulphureous
thermal springs* are seen issuing from the soil; and at length we reach the borders of the lake of Campoma, the exhalations from which contribute to the insalubrity of the climate of Cariaco. The natives believe that the hoilow is formed by the engulfing of the hot springs; and, judging from the sound heard under the hoofs of the horses, we must conclude that the subterranean cavities are continued from west to east nearly as far as Casanay, a length of three or four thousand toises. A little river, the Rio Azul, runs through these plains, which are rent into crevices by earthquakes. These earthquakes have a particular centre of action, and seldom extend as far as Cumana. The waters of the Rio Azul are cold and limpid; they rise on the western declivity of the mountain of Meapire, and it is believed that they are augmented by infiltrations from the lake Putacuas, situated on the other side of the chain. The little river, together with the sulphureous hot springs, fall into the Laguna de Campoma. This is a name given to a great lagoon, which is divided in dry weather into three basins situated north-west of the town of Cariaco, near the extremity of the gulf. Fetid exhalations arise continually from the stagnant water of this lagoon. The smell of sulphuretted hydrogen is mingled with that of putrid fishes and rotting plants.

Miasms are formed in the valley of Cariaco, as in the Campagna of Rome; but the hot climate of the tropics increases their deleterious energy. These miasms are probably ternary or quaternary combinations of azote, phosphorus, hydrogen, carbon, and sulphur.

The situation of the lagoon of Campoma renders the north-west wind, which blows frequently after sunset, very pernicious to the inhabitants of the little town of Cariaco. Its influence can be the less doubted, as intermitting fevers are observed to degenerate into typhoid fevers, in proportion as we approach the lagoon, which is the principal focus of putrid miasms. Whole families of free negroes, who have small plantations on the northern coast of the gulf of Cariaco, languish in their hammocks from the beginning of the rainy season. These intermittent fevers assume a dan-

* El Llano de Aguas calientes, E. N. E. of Cariaco, at the distance of two leagues.
gerous character, when persons, debilitated by long labour and copious perspiration, expose themselves to the fine rains, which frequently fall as evening advances. Nevertheless, the men of colour, and particularly the Creole negroes, resist much better than any other race, the influence of the climate. Lemonade and infusions of Scoparia dulcis are given to the sick; but the cuspare, which is the cinchona of Angostura, is seldom used.

It is generally observed, that in these epidemics of the town of Cariaco the mortality is less considerable than might be supposed. Intermitting fevers, when they attack the same individual during several successive years, enfeeble the constitution; but this state of debility, so common on the unhealthy coasts, does not cause death. What is remarkable enough, is the belief which prevails here as in the Campagna of Rome, that the air has become progressively more vitiated in proportion as a greater number of acres have been cultivated. The miasms exhaled from these plains have, however, nothing in common with those which arise from a forest when the trees are cut down, and the sun heats a thick layer of dead leaves. Near Cariaco the country is but thinly wooded. Can it be supposed that the mould, fresh stirred and moistened by rains, alters and vitiates the atmosphere more than the thick wood of plants which covers an uncultivated soil? To local causes are joined other causes less problematic. The neighbouring shores of the sea are covered with mangroves, avicennias, and other shrubs with astringent bark. All the inhabitants of the tropics are aware of the noxious exhalations of these plants; and they dread them the more, as their roots and stocks are not always under water, but alternately.wetted and exposed to the heat of the sun.* The mangroves produce miasms, because they contain vegeto-animal matter combined with tannin.

[^99]The town of Cariaco has been repeatedly sacked in former times by the Caribs. Its population has augmented rapidly since the provincial authorities, in spite of prohibitory orders from the court of Madrid, have often favoured the trade with foreign colonies. The population amounted, in 1800 , to more than 6000 souls. The inhabitants are active in the cultivation of cotton, which is of a very fine quality. The capsules of the cotton-tree, when separated from the woolly substance, are carefully burnt; as those husks if thrown into the river, and exposed to putrefaction, yield noxious exhalations. The culture of the caca-tree has of late considerably diminished. This valuable tree bears only after eight or ten years. Its fruit keeps very badly in the warehouses, and becomes mouldy at the expiration of a year, notwithstanding all the precautions employed for drying it.

It is only in the interior of the province, to the east of the Sierra de Meapire, that new plantations of the cacaotree are seen. They become there the more productive, as the lands, newly cleared and surrounded by forests, are in contact with an atmosphere damp, stagnant, and loaded with mephitic exhalations. We there see fathers of families, attached to the old habits of the colonists, slowly amass a little fortune for themselves and their children. Thirty thousand cacao-trees will secure competence to a family for a generation and a half. If the culture of cotton and coffee have led to the diminution of cacao in the province of Caracas and in the small valley of Cariaco, it must be admitted that this last branch of colonial industry has in general increased in the interior of the provinces of New Barcelona and Cumana. The causes of the progressive movement of the cacao-tree from west to east may be easily conceived. The province of Caracas has been from a remote period cultivated: and, in the torrid zone, in proportion as a country has been cleared, it becomes drier and more exposed to the winds. These physical changes have been adverse to the propagation of cacao-trees, the plantations of which, diminishing in the province of Ca racas, have accumulated eastward on a newly-cleared and virgin soil. The cacao of Cumana is infinitely superior to that of Guayaquil. The best is produced in the valley of San Bonifacio; as the best cacao of New Barcelona, Cara-
cas, and Guatimala, is that of Capiriqual, Uritucu, and Soconusco. Since the island of Trinidad has become an English colony, the whole of the eastern extremity of the province of Cumana, especially the coast of Paria, and the gulf of the same name, have changed their appearance. Foreigners have settled there, and have introduced the cultivation of the coffee-tree, the cotton-tree, and the sugarcane of Otaheite. The population has greatly increased at Carupano, in the beautiful valley of Rio Caribe, at Guira, and at the new town of Punta di Piedra, built opposite Spanish Harbour, in the island of Trinidad. The soil is so fertile in the Golfo Triste, that maize yields two harvests in the year, and produces three hundred and eighty fold the quantity sown.

Early in the morning we embarked in a sort of narrow canoe, called a lancha, in hopes of crossing the gulf of Cariaco during the day. The motion of the waters resembles that of our great lakes, when they are agitated by the winds. From the embarcadero to Cumana the distance is only twelve nautical leagues. On quitting the little town of Cariaco, we proceeded westward along the river of Carenicuar, which, in a straight line like an artificial canal, runs through gardens and plantations of cotton-trees. On the banks of thè river of Cariaco we saw the Indian women washing their linen with the fruit of the parapara (Sapindus saponaria, or soap-berry), an operation said to be very injurious to the linen. The bark of the fruit produces a strong lather; and the fruit is so elastic that if thrown on a stone it rebounds three or four times to the height of seven or eight feet. Being of a spherical form, it is employed in making rosaries.

After we embarked we had to contend against contrary winds. The rain fell in torrents, and the thunder rolled very near. Swarms of flamingoes, egrets, and cormorants filled the air, seeking the shore, whilst the alcatras, a large species of pelican, alone continued peaceably to fish in the middle of the gulf. The gulf of Cariaco is almost everywhere forty-five or - fifty fathoms deep; but at its eastern extremity, near Curaguaca, along an extent of five leagues, the lead does not indicate more than three or four fathoms. Here is found the Baxo de la Cotua, a sand-bank, which at low-water appears like a small island. The canoes which carry provisions to Cumana
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sometimes ground on this bank; but always without danger, because the sea is never rough or heary. We crossed that part of the gulf where hot springs gush from the bottom of the sea. It was flood-tide, so that the change of temperature was not very perceptible: besides, our canoe drove too much towards the southern shore. It may be supposed that strata of water must be found of different temperatures, according to the greater or less depth, and according as the mingling of the hot waters with those of the gulf is accelerated by the winds and currents. The existence of these hot springs, which we were assured raise the temperature of the sea through an extent of ten or twelve thousand square toises, is a very remarkable phenomenon.* Proceeding from the promontory of Paria westward, by Irapa, Aguas Calientes, the gulf of Cariaco, the Brigantine, and the valley of Aragua, as far as the snowy mountains of Merida, a continued band of thermal waters is found in an extent of 150 leagues.

Adverse winds and rainy weather forced us to go on shore at Pericantral, a small farm on the south side of the gulf. The whole of this coast, though covered with beautiful vegetation, is almost wholly uncultivated. There are scarcely seven hundred inhabitants: and, excepting in the village of Mariguitar, we saw only plantations of cocoa-trees, which are the olives of the country. This palm occupies on both continents a zone, of which the mean temperature of the year is not below $20^{\circ} . \dagger$ It is, like the chamærops of the basin of the Mediterranean, a true palm-tree of the coast. It prefers salt to fresh water; and flourishes less inland, where the air is not loaded with saline particles, than on the shore: When cocoa-trees are planted in Terra-Firma, or in the Missions of the Orinoco, at a distance from the sea, a considerable quantity of salt, sometimes as much as half a bushel, is thrown into the hole which receives the nut. Among the plants cultivated by man, the sugar-cane, the plantain, the mammee-apple, and alligator-pear (Laurus per-

[^100]sea), alone have the property of the cocoa-tree; that of being watered equally well with fresh and salt water. This circumstance is favourable to their migrations; and if the sugarcane of the sea-shore yield a syrup that is a little brackish, it is believed at the same time to be better fitted for the distillation of spirit than the juice produced from the canes in inland situations.

The cocoa-tree, in the other parts of America, is in general cnltivated around farm-houses, and the fruit is eaten; in the gulf of Cariaco, it forms extensive plantations. - In a fertile and moist ground, the tree begins to bear fruit abundantly in the fourth year; but in dry soils it bears only at the expiration of ten years. The duration of the tree does not in general exceed eighty or a humdred years; and its mean height at that age is from seventy to eighty feet. This rapid growth is so much the more remarkable, as other palm-trees, for instance, the moriche,* and the palm of Sombrero, $\dagger$ the longevity of which is very great, frequently do not attain a greater beightthan fourteen or eighteen feet in the space of sixty years. In the first thirty or forty years, a cocoa-tree of the gulf of Cariaco bears every lunation a cluster of ten or fourteen nuts, all of which, however, do not ripen. It may be reckoned that, on an average, a tree produces annually $a$ handred nuts, which yield eight flascos $\ddagger$ of oil. In Provence, an olive-tree thirty years old yields twenty pounds, or seven flascos of oil, so that it produces something less than a cocoa-tree. There are in the gulf of Cariaco plantations (haciendas) of eight or nine thousand cocoa-trees. They resemble, in their picturesque appearance, those fine plantations of date-trees near Elche, in Murcia, where, over the superficies of one square league, there may be found upwards of 70,000 palms. The cocoatree bears fruit in abundance till it is thirty or forty years old; after that age the produce diminishes, and a trunk a hundred years old, without being altogether barren, yields very little. In the town of Cumana there is prepared a great quantity of cocoa-nut oil, which is limpid, without smell, and very fit for burning. The trade in this oil is not less active than that on the coast of Africa for palm-oil, which is obtained from the

Elais guineensis, and is used as food. I have often seen canoes arrive at Cumana laden with 3000 cocoa-nuts.

We did not quit the farm of Pericantral till after sunset. The south coast of the gulf presents a most fertile aspect, while the northern coast is naked, dry, and rocky. In spite of this aridity, and the scarcity of rain, of which sometimes none falls for the space of fifteen months,* the peninsula of Araya, like the desert of Canound in India, produces patillas, or water-melons, weighing from fifty to seventy pounds. In the torrid zone, the vapours contained by the air form about nine-tenths of the quantity necessary to its saturation: and vegetation is maintained by the property which the leaves possess of attracting the water dissolved in the atmosphere.

At sunrise, we saw the Zamuro vultures, $\dagger$ in flocks of forty or fifty, perched on the cocoa-trees. These birds range themselves in files to roost together like fowls. They go to roost long before sunset, and do not awake till after the sun is above the horizon. This sluggishness seems as if it were shared in those climates by the trees with pinnate leaves. The mimosas and the tamarinds close their leaves, in a clear and serene sky, twenty-five or thirty-five minutes before sunset, and unfold them in the morning when the solar disk has been visible for an equal space of time. As I noticed pretty regularly the rising and setting of the sun, for the purpose of observing the effect of the mirage, or of the terrestrial refractions, I was enabled to give continued attention to the phenomena of the sleep of plants. I found them the same in the steppes, where no irregularity of the ground interrupted the view of the horizon. It appears, that, accustomed during the day to an extreme brilliancy of light, the sensitive and other leguminous plants with thin and delicate leaves are

* The rains appear to have been more frequent at the beginning of the 16th century. At any rate, the canon of Granada (Peter Martyr d'Anghiera), speaking in the year 1574, of the salt-works of Araya, or of Haraia, described in the fifth chapter of this work, mentions showers (cadentes imbres) as a very common phenomenon. The same author, who died in 1526, affirms that the Indians wrought the salt-works before the arrival of the Spaniards. They dried the salt in the form of bricks; and our writer even then discussed the geological question, whether the clayey soil of Haraia contained salt-springs, or whether it had been impregnated with salt by the periodical inundations of the ocean for ages.
t Vultur aura.

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affected in the evening by the smallest decline in the intensity of the sun's rays; so that for vegetation, night begins there, as with us, before the total disappearance of the solar disk. But why, in a zone where there is scarcely any twilight, do not the first rays of the sun stimulate the leaves with the more strength, as the absence of light must have rendered them more susceptible? Does the humidity deposited on the parenchyma by the cooling of the leaves, which is the effect of the nocturnal radiation, prevent the action of the first rays of the sun? In our climates, the leguminous plants with irritable leaves awake during the twilight of the morning, before the sun appears.

## Chapter IX.

Physical Constitution and Manners of the Chaymas.-Their Language. -Filiation of the Nations which inhabit New Andalusia.-Pariagotos seen by Columbus.
I DID not wish to mingle with the narrative of our journey to the Missions of Caripe any general considerations on the different tribes of the indigenous inhabitants of New Andalusia; their manners, their languages, and their common origin. Having returned to the spot whence we set out, I shall now bring into one point of view these considerations which are so nearly connected with the history of the human race. As we advance into the interior of the country, these subjects will become even more interesting than the phenomena of the physical world. The north-east part of equinoctial America, Terra-Firma, and the banks of the Orinoco, resemble in respect to the numerous races of people who inhabit them, the defiles of the Caucasus, the mountains of Hindookho, at the northern extremity of Asia, beyond the Tungouses, and the Tartars settled at the mouth of the Lena. The barbarism which prevails throughout these different regions is perhaps less owing to a primitive absence of all kind of civilization, than to the effects of long degradation; for most of the hordes which we designate under the name of savages, are probably the descendants of nations highly advanced in cultivation. How can we distinguish the prolonged infancy of the human race (if, indeed, it anywhere exists), from that state of moral degradation in which solitude, want, com-
pulsory misery, forced migration, or rigour of climate, obliterate even the traces of civilization? If everything connected with the primitive state of man, and the first population of a continent, could from its nature belong to the domain of history, we might appeal to the traditions of India. According to the opinion frequently expressed in the laws of Menou and in the Ramajan, savages were regarded as tribes banished from civilized society, and driven into the forests. The word barbarian, which we have borrowed from the Greeks and Romans, was possibly merely the proper name of one of those rude hordes.

In the New World, at the begining of the conquest, the gatives were collected into large societies only on the ridge of the Cordilleras and the coasts opposite to Asia. The plains, covered with forests, and intersected by rivers; the immense savannahs, extending eastward, and bounding the horizon; were inhabited by wandering hordes, sepasated by differences of language and manners, and scattered like the remnants of a vast wreck. In the absence of all other monuments, we may endeavour, from the analogy of languages, and the study of the physical constitution of man, to group the different tribes, to follow the traces of their distant emigrations, and to discover some of those family features by which the ancient unity of our species is manifested.

In the mountainous regions which we have just tra-versed,-in the two provinces of Cumana and New Barcelona, the natives, or primitive inhabitants, still constitute about one-half of the seanty population. Their number may be reckoned at sixty thousand; of which twenty-four thousand inhabit New Andalusia. This number is very considerable, when compared with that of the hunting nations of North America; but it appears small, when we consider those parts of New Spain in which agriculture has existed more than eight centuries: for instance, the Intendencia of Oaxaca, which includes the Mixteca and the Tzapoteca of the old Mexican empire. This Intendencia is onethird smaller than the two provinces of Cumana and Barcelona; yet it contains more than four hundred thousand natives of pure copper-coloured race. The Indians of Cumana do not all live within the Missions. Some are dispersed in the neighbourhood of the towns, along the coasts,
to which they are attracted by the fisheries, and some dwell in little farms on the plains or savannahs. The Missions of the Aragonese Capuchins which we visited, alone contain fifteen thousand Indians, almost all of the Chayma race. The villages, however, are less populous there than in the province of Barcelona. Their average population is only between five or six hundred Indians; while more to the west, in the Missions of the Franciscans of Piritu, we find Indian villages containing two or three thousand inhabitants. In computing at sixty thousand the number of natives in the provinces of Cumana and Barcelona, I include only those who inhabit the mainland, and not the Guayquerias of the island of Margareta, and the great mass of the Guaraunos, who have preserved their independence in the islands formed by the Delta of the Orinoco. The number of these is generally reckoned at six or eight thousand; but this estimate appears to me to be exaggerated. Except a few families of Guaraunos who roam occasionally in the marshy grounds, called Los Morichales, and between the Caño de Manamo and the Rio Guarapiche, consequently, on the continent itself, there have not been for these thirty years, any Indian savages in New Andalusia.

I use with regret the word savage, because it implies a difference of cultivation between the reduced Indian, living in the Missions, and the free or independent Indian; a difference which is often belied by fact. In the forests of South America there are tribes of natives, peacefully united in villages, and who render obedience to chiefs.* They cultivate the plantain-tree, cassava, and cotton, on a tolerably extensive tract of ground, and they employ the cotton for weaving hammocks. These people are scarcely more barbarous than the naked Indians of the Missions, who have been taught to make the sign of the cross. It is a common error in Europe, to look on all natives not reduced to a state of subjection, as wanderers and hunters. Agriculture was practised on the American continent long before the arrival of Europeans. It is still practised between the Orinoco and the river Amazon, in lands cleared amidst the forests, places to which the missionaries have never penetrated. It would be to imbibe false ideas respecting the actual condition of the nations of South America, to consider as synonymous the

[^101]denominations of 'Christian,' ' reduced,' and 'civlized;' and those of ' pagan,' 'savage,' and 'independent.' The reduced Indian is often as little of a Christian as the independent Indian is of an idolater. Both, alike occupied by the wants of the moment, betray a marked indifference for religious sentiments, and a secret tendency to the worship of nature and her powers. This worship belongs to the earliest infancy of nations; it excludes idols, and recognises no other sacred places than grottoes, valleys, and woods.

If the independent Indians have nearly disappeared for a century past northward of the Orinoco and the Apure, that is, from the Snowy Mountains of Merida to the promontory of Paria, it must not thence be concluded, that there are fewer natives at present in those regions, than in the time of the bishop of Chiapa, Bartolomeo de las Casas. In my work on Mexico, I have shown that it is erroneous to regard as a general fact the destruction and diminution of the Indians in the Spanish colonies. There still exist more than six millions of the copper-coloured race, in both Americas; and, though numberless tribes and languages are either extinct, or confounded together, it is beyond a doubt that, within the tropics, in that part of the New World where civilization has penetrated only since the time of Columbus, the number of natives has considerably increased. Two of the Carib villages in the Missions of Piritu or of Carony, contain more families than four or five of the settlements on the Orinoco. The state of society among the Caribbees who have preserved their independence, at the sources of the Essequibo and to the south of the mountains of Pacaraimo, sufficiently proves how much, even among that fine race of men, the population of the Missions exceeds in number that of the free and confederate Caribbees. Besides, the state of the savages of the torrid zone is not like that of the savages of the Missouri. The latter require a vast extent of country, because they live only by hunting; whilst the Indians of Spanish Guiana employ themselves in cultivating cassava and plantains. A very little ground suffices to supply them with food. They do not dread the approach of the whites, like the savages of the United States; who, being progressively driven back behind the Alleghany mountains, the Ohio, and the Mississippi, lose their means of subsistence, in proportion as they find themselves reduced within narrow limits. Under the
temperate zone, whether in the provincias internas of Mexico, or in Kentucky, the contact of European colonists has been fatal to the natives, because that contact is immediate.

These causes have no existence in the greater part of South America. Agriculture, within the tropics, does not require great extent of ground. The whites advance slowly. The religious orders have founded their establishments between the domain of the colonists and the territory of the free Indians. The Missions may be considered as intermediary states. They have doubtless encroached on the liberty of the natives ; but they have almost everywhere tended to the increase of population, which is incompatible with the restless life of the independent Indians. As the missionaries advance towards the forests, and gain on the natives, the white colonists in their turn seek to invade in the opposite direction the territory of the Missions. In this protracted struggle, the secular arm continually tends to withdraw the reduced Indian from the monastic hierarchy, and the missionaries are gradually superseded by vicars. The whites, and the castes of mixed blood, favoured by the corregidors, establish themselves among the Indians. The Missions become Spanish villages, and the natives lose even the rememmbrance of their natural language. Such is the progress of civilization from the coasts toward the interior; a slow progress, retarded by the passions of man, but nevertheless sure and steady.

The provinces of New Andalusia and Barcelona, comprehended under the name of Govierno de Cumana, at present include in their population more than fourteen tribes. Those in New Andalusia are the Chaymas, Guayqueries, Pariagotos, Quaquas, Aruacas, Caribbees, and Guaraunos; in the province of Barcelona, Cumanagotos, Palenkas, Caribbees, Piritus, Tomuzas, Topocuares, Chacopatas, and Guarivas. Nine or ten of these fifteen tribes consider themselves to be of races entirely distinct. The exact number of the Guaraunos, who make their huts on the trees at the mouth of the Orinoco, is unknown; the Guayqueries, in the suburbs of Cumana and in the peninsula of Araya, amount to two thousand. Among the other Indian tribes, the Chaymas of the mountains of Caripe, the Caribs of the southern savannahs of New Barcelona, and the Cumanagotos in the Missions of Piritu, are most
numerous. Some families of Guaraunos have been reduced and dwell in Missions on the left bank of the Orinoco, where the Delta begins. The languages of the Guaraunos and that of the Caribs, of the Cumanagotos and of the Chaymas, are the most general. They seem to belong to the same stock; and they exhibit in their grammatical forms those affinities, which, to use a comparison taken from languages more known, connect the Greek, the German, the Persian, and the Sanscrit.

Notwithstanding these affinities, we must consider the Chaymas, the Guaraunos, the Caribbees, the Quaquas, the Aruacas or Arrawaks, and the Cumanagotos, as different nations. I would not venture to affirm the same of the Guayqueries, the Pariagotos, the Piritus, the Tomuzas, and the Chacopatas. The Guayquerias themselves admit the analogy between their language and that of the Guaraunos. Both are a littoral race, like the Malays of the ancient continent. With respect to the tribes who at present speak the Cumanagota, Caribbean, and Chayma tongues, it is difficult to decide on their first origin, and their relations with other nations formerly more powerful. The historians of the conquest, as well as the ecclesiastics who have described the progress of the Missions, continually confound, like the ancients, geographical denominations with the names of races. They speak of Indians of Cumana and of the coast of Paria, as if the proximity of abode proved the identity of origin. They most commonly even give to tribes the names of their chiefs, or of the mountains or valleys they inhabit. This circumstance, by infinitely multiplying the number of tribes, gives an air of uncertainty to all that the monks relate respecting the heterogeneous elements of which the population of their Missions are composed. How can we now decide, whether the Tomuza and Piritu be of different races, when both speak the Cumanagoto language, which is the prevailing tongue in the western part of the Govierno of Cumana; as the Caribbean and the Chayma are in the southern and eastern parts. A great analogy of physical constitution increases the difficulty of these inquiries. In the new continent a surprising variety of languages is observed among nations of the same origin, and which European travellers scarcely distinguish by their features; while in
. the old continent very different races of men, the Laplanders, the Finlanders, and the Esthonians, the Germanic nations and the Hindoos, the Persians and the Kurds, the Tartar and Mongol tribes, speak languages, the mechanism and roots of which present the greatest analogy.

The Indians of the American Missions are all agriculturists. Excepting those who inhabit the high mountains, they all cultivate the same plants; their huts are arranged in the same manner ; their days of labour, their work in the conuco of the community; their connexions with the missionaries and the magistrates chosen from among themselves, are all subject to uniform regulations. Nevertheless (and this fact is very remarkable in the history of nations), these analogous circumstances have not effaced the individual features, or the shades of character which distinguish the American tribes. We observe in the men of copper hue, a moral inflexibility, a stedfast perseverance in habits and manners, which, though modified in each tribe, characterise essentially the whole race. These peculiarities are found in every region; from the equator to Hudson's Bay on the one hand, and to the Straits of Magellan on the other. They are connected with the physical organization of the natives, but they are powerfully favoured by the monastic system.

There exist in the missions few villages in which the different families do not belong to different tribes and speak different languages. Societies composed of elements thus heterogeneous are difficult to govern. In general, the monks have united whole nations, or great portions of the same nations, in villages situated near to each other. The natives see only those of their own tribe; for the want of communication, and the isolated state of the people, are essential points in the policy of the missionaries. The reduced Chaymas, Caribs, and Tamanacs, retain their natural physiognomy, whilst they have preserved their languages. If the individuality of man be in some sort reflected in his idioms, these in their turn re-act on his ideas and sentiments. It is this intimate connection between language, character, and physical constitution, which maintains and perpetuates the diversity of nations; that unfailing source of life and motion in the intellectual world.

The missionaries may have prohibited the Indians from following certain practices and observing certain ceremo-
nies; they may have prevented them from painting their skin, from making incisions on their chins, noses and cheeks; they may have destroyed among the great mass of the people superstitious ideas, mysteriously transmitted from father to son in certain families; but it has been easier for them to proscribe customs and efface remembrances, than to substitute new ideas in the place of the old ones.

The Indian of the Mission is secure of subsistence; and being released from continual struggles against hostile powers, from conflicts with the elements and man, he leads a more monotonous life, less active, and less fitted to inspire energy of mind, than the habits of the wild or independent Indian. He possesses that mildness of character which belongs to the love of repose; not that which arises from sensibility and the emotions of the soul. The sphere of his ideas is not enlarged, where, having no intercourse with the whites, he remains a stranger to those objects with which European civilization has enriched the New World. All his actions seem prompted by the wants of the moment. Taciturn, serious, and absorbed in himself, he assumes a sedate and mysterious air. When a person has resided but a short time in the Missions, and is but little familiarized with the aspect of the natives, he is led to mistake their indolence, and the torpid state of their faculties, for the expression of melancholy, and a meditative turn of mind.

I have dwelt on these features of the Indian character, and on the different modifications which that character exhibits under the government of the missionaries, with the view of rendering more intelligible the observations which form the subject of the present chapter. I shall begin by the nation of the Chaymas, of whom more than fifteen thousand inhabit the Missions above noticed. The Chayna nation, which Father Francisco of Pampeluna* began to reduce to subjection in the middle of the seventeenth century, has the Cumanagotos on the west, the Guaraunos on the east, and the Caribbees on the south. Their territory occupies a space along the elevated mountains of the Cocollar and the Guacharo, the banks of the Guarapiche, of

[^102]the Rio Colorado, of the Areo, and of the Caño de Caripe. According to a statistical survey made with great care by the father prefect, there were, in the Missions of the Aragonese Capuchins of Cumana, nineteen Mission villages, of which the oldest was established in 1728, containing one thousand four hundred and sixty-five families, and six thousand four hundred and thirty-three persons : sixteen doctrina villages, of which the oldest dates from 1660, containing one thousand seven hundred and sixty-six families, and eight thousand one hundred and seventy persons. These Missions suffered greatly in 1681, 1697, and 1720, from the invasions of the Caribbees (then independent), who burnt whole villages. From 1730 to 1736 , the population was diminished by the ravages of the small-pox, a disease always more fatal to the copper-coloured Indians than to the whites. Many of the Guaraunos, who had been assembled together, fled back again to their native marshes. Fourteen old Missions were deserted, and have not been rebuilt.

The Chaymas are in general short of stature and thickset. Their shoulders are extremely broad, and their chests - flat. Their limbs are well rounded, and fleshy. Their colour is the same as that of the whole American race, from the cold table-lands of Quito and New Grenada to the burning plains of the Amazon. It is not changed by the varied influence of climate; it is connected with organic peculiarities which for ages past have been unalterably transmitted from generation to generation. If the uniform tint of the skin be redder and more coppery towards the north, it is, on the contrary, among the Chaymas, of a dull brown inclining to tawny. The denomination of copper-coloured men could never have originated in equinoctial America to designate the natives.

The expression of the countenance of the Chaymas, without being hard or stern, has something sedate and gloomy. The forehead is small, and but little prominent, and in several languages of these countries, to express the beauty of a woman, they say that 'she is fat, and has a narrow forehead.' The eyes of the Chaymas are black, deep-set, and very elongated: but they are neither so obliquely placed, nor so small, as in the people of the Mongol race. The corner of the eye is, however, raised up towards the
temple; the eyebrows are black, or dark brown, thin, and but little arched; the eyelids are edged with very long eyelashes, and the habit of casting them down, as if from lassitude, gives a soft expression to the women, and makes the eye thus veiled appear less than it really is. Though the Chaymas, and in general all the natives of South America and New Spain, resemble the Mongol race in the form of the eye, in their high cheek-bones, their straight and smooth hair, and the almost total absence of beard; yet they essentially differ from them in the form of the nose. In the South Americans this feature is rather long, prominent through its whole length, and broad at the nostrils, the openings of which are directed downward, as with all the nations of the Caucasian race. Their wide mouths, with lips but little protuberant though broad, have generally an expression of good nature. The passage from the nose to the mouth is marked in both sexes by two furrows, which run diverging from the nostrils towards the comers of the mouth. The chin is extremely short and round; and the jaws are remarkable for strength and width.

Though the Chaymas have fine white teeth, like all people who lead a very simple life, they are, however, not so strong as those of the Negroes. The habit of blackening the teeth, from the age of fifteen, by the juices of certain herbs* and caustic lime, attracted the attention of the earliest travellers; but the practice has now fallen quite into disuse. Such have been the migrations of the different tribes in these countries, particularly since the incursions of the Spaniards, who carried on the slave-trade, that it may be inferred the inhabitants of Paria visited by Christopher Columbus and by Ojeda, were not of the same race as the Chaymas. I doubt much whether the custom of blackening the teeth was originally suggested, as Gomara supposed, by absurd notions of beauty, or was practised with the riew of preventing the

[^103]toothache.* This disorder is, however, almost unknown to the Indians; and the whites suffer seldom from it in the Spanish colonies, at least in the warm regions, where the temperature is so uniform. They are mare exposed to it on the back of the Cordilleras, at Santa-Fe, and at Popayan.

The Chaymas, like almost all the native nations I have seen, have small, slender hands. Their feet are large, and their toes retain an extraordinary mobility. All the Chaymas have a sort of family look; and this resemblanoe, so often observed by travellers, is the more striking, as between the ages of twenty and fifty, difference of years is no way denoted by wrinkles of the skin, colour of the hair, or decrepitude of the body. On entering a hut, it is often difficult among adult persons to distinguish the father from the son, and not to confound one generation with another. I attribute this air of family resemblance to two different causes, the local situation of the Indian tribes, and their inferior degree of intellectual culture. Savage nations are subdivided into an infinity of tribes, which, bearing violent hatred one to another, form no intermarriages, even when their languages spring from the same root, and when only a small arm of a river, or a group of hills, separates their habitations. The less numerous the tribes, the more the intermarriages repeated for ages between the same families tend to fix a certain similarity of conformation, an organic type, which may be called national. This type is preserved under the system of the Missions, each Mission being formed by a single horde, and marriages being contracted only between the inhabitants of the same hamlet. Those ties of blood which unite almost a whole nation, are indicated in a simple

* The tribes seen by the Spaniards on the coast of Paria, probably observed the practice of stimulating the organs of taste by canstic lime, as other races employed tobacco, the chimo, the leaves of the coca, or the betel. This practice exists even in our days, but more towards the west. among the Guajiros, at the moath of the Rio de la Hacha. These Indians, still savage, carry small shells, calcined and powdered, in the husk of a fruit, which serves them as a vessel for various purposes, suspended to their girdle. The powder of the Guajiros is an article of commerce, as was anciently, according to Gomara, that of the Indians of Paria. The immoderate habit of amoking also makes the teeth yellow and blackens them; but would it be just to conclude from this fact, that Europeans amoke because we think yellow teeth handsomer than white?
manner in the language of the Indians born in the Missions, or by those who, after having been taken from the woods, have learned Spanish. To designate the individuals who belong to the same tribe, they employ the expression mis parientes, my relations.

With these causes, common to all isolated classes, and the effects of which are observable among the Jews of Europe, among the different castes of India, and among mountain nations in general, are combined some other causes hitherto unnoticed. I have observed elsewhere, that it is intellectual culture which most contributes to diversify the features. Barbarous nations have a physiognomy of tribe or of horde, rather than individuality of look or features. The savage and civilized man are like those animals of an individual species, some of which roam in the forest, while others, associated with mankind, share the benefits and evils which accompany civilization. Varieties of form and colour are frequent only in domestic animals. How great is the difference, with respect to mobility of features and variety of physiognomy, between dogs which have again returned to the savage state in the New World, and those whose slightest caprices are indulged in the houses of the opulent! Both in men and animals the emotions of the soul are reflected in the features; and the countenance acquires the habit of mobility, in proportion as the emotions of the mind are frequent, varied, and durable. But the Indian of the Missions, being remote from all cultivation, influenced only by his physical wants; satisfying almost without difficulty his desires, in a favoured climate, drags on a dull, monotonous life. The greatest equality prevails among the members of the same community; and this uniformity, this sameness of situation, is pictured on the features of the Indians.

Under the system of the monks, violent passions, such as resentment and anger, agitate the native more rarely than when he lives in the forest. When man in a savage state yields to sudden and impetuous emotions, his physiognomy, till then calm and unruffled, changes instantly to convulsive contortions. His passion is transient in proportion to its violence. With the Indians of the Missions, as I have often observed on the Orinoco, anger is less violent, less earnest, but of longer duration. Besides, in every con-
dition of man, it is not the energetic or the transient outbreaks of the passions, which give expression to the features, it is rather that sensibility of the soul, which brings us continually into contact with the external world, multiplies our sufferings and our pleasures, and re-acts at once on the physiognomy, the manners, and the language. If the variety and mobility of the features embellish the domain of animated nature, we must admit also, that both increase by civilization, without being solely produced by it. In the great family of nations, no other race unites these advantages in so high a degree as the Caucasian or European. It is only in white men that the instantaneous penetration of the dermoidal system by the blood can produce that slight change of the colour of the skin which adds so powerful an expression to the emotions of the soul. "How can those be trusted who know not how to blush ?" says the European, in his dislike of the Negro and the Indian. We must also admit, that immobility of features is not peculiar to every race of men of dark complexion: it is much less marked in the African than in the natives of America.

The Chaymas, like all savage people who dwell in excessively hot regions, have an insuperable aversion to clothing. The writers of the middle ages inform us, that in the north of Europe, articles of clothing distributed by missionaries, greatly contributed to the conversion of the pagan. In the torrid zone, on the contrary, the natives are ashamed (as they say) to be clothed; and flee to the woods, when they are compelled to cover themselves. Among the Chaymas, in spite of the remonstrances of the monks, men and women remain unclothed within their houses. When they go into the villages they put on a kind of tunic of cotton, which scarcely reaches to the knees. The men's tunics have sleeves; but women, and young boys to the age of ten or twelve, have the arms, shoulders, and upper part of the breast uncovered. The tunic is so shaped, that the forepart is joined to the back by two narrow bands, which cross the shoulders. When we met the natives, out of the boundaries of the Mission, we saw them, especially in rainy weather, stripped of their clothes, and holding their shirts rolled up under their arms. They preferred letting the rain fall on their bodies to wetting their clothes. The elder
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women hid themselves behind trees, and burst into loud fits of laughter when they saw us pass. The missionaries complain that in general the young girls are not more alive to feelings of decency than the men. Ferdinand Columbus* relates that, in 1498, his father found the women in the island of Trinidad without any clothing; while the men wore the guayuco, which is rather a narrow bandage than an apron. At the same period, on the coast of Paria, young girls were distinguished from married women, either, as Cardinal Bembo states, by being quite unclathed, or, according to Gomara, by the colour of the guayuco. This bandage, which is still in use among the Chaymas, and all the naked nations of the Orinoco, is only two or three inches broad, and is tied on both sides to a string which encircles the waist. Girls are often married at the age of twelve; and until they are nine years old, the missionaries allow them to go to ohurch unclothed, that is to say, without a tunic. Among the Chaymas, as well as in all the Spanish Missions and the Indian villages, a pair of drawers a pair of shoes, or a hat, are objects of luxury unknown to the natives. An Indian servent, who had been with us during our journey to Caripe and the Orinoco, and whom I braught to France, was so mueh struck, on landing, when he saw the ground tilled by a peasant with his hat on, that he thought himself in a miserable country, where even the nobles (los mismos caballeros) follawed the plough. The Chayma women are not handsome, according to the ideas we annez to beauty; yet the young girls have a look of softness and melancholy, contrasting agreeably with the expression of the mouth, which is somewhat harsh and wild. They wear their hair plaited in two long tresses; they do not paint their skin; and wear no other ornaments than necklaces and bracelets made of shells, birds' bones, and seeds. Both men and women are very muscular, but at the same time fleshy and plump. I saw no person who had any natural

* Life of the Adelantado: Churchill's Collection, 1723. This Life, writhon after the year 1537, from original notes in the handwriting of Chriatopher Columbus himself, is the most valuable record of the history of his discoveries. It exists only in the Italian and Spanish translations of Alphonso de Ulloa and Gonzalea Barcia: fur the original, carried to Venice in 1571 by the learned Fornari, has not been published, and is supposed to be lost. 'Napione della Patria di Colombo,'-1804. 'Cancellieri sopra Christ. Colombo,'-1809.
deformity; and I may say the same of thousands of Caribs, Muyscas, and Mexican and Peruvian Indians, whom we observed during the course of five years. Bodily deformities, and deviations from nature, are exceedingly rare among certain races of men, especially those who have the epidermis highly coloured; but I cannot believe that they depend solely on the progress of civilization, a luxurious life, or the corruption of morals. In Europe a deformed or very ugly girl marries, if she happen to have a fortune, and the children often inherit the deformity of the mother. In the savage state, which is a state of equality, no consideration can induce a man to unite himself to a deformed woman, or one who is very unhealthy. Such a woman, if she resist the accidents of a restless and troubled life, dies without children. We might be tempted to think, that savages all appear wellmade and vigorous, because feeble children die young for want of care, and only the strongest survive; but these causes cannot operate among the Indians of the Missions, whose manners are like those of our peasants, or among the Mexicans of Cholula and Tlascala, who enjoy wealth, transmitted to them by ancestors more civilized than themselves. If, in every state of cultivation, the copper-coloured race manifests the same inflexibility, the same resistance to deviation from a primitive type, are we not forced to admit that this peculiarity belongs in great measure to hereditary organization, to that which constitutes the race? With coppercoloured men, as with whites, luxury and effeminacy weaken the physical constitution, and heretofore deformitios were more common at Cuzco and Tenochtitlan. Among the Mexicans of the present day, who are all labourers, leading the most simple lives, Montezuma would not have found those dwarfs and humpbacks whom Bernal Diaz saw waiting at his table when he dined.* The custom of marrying very young, according to the testimony of the monks, is no way detrimental to population. This precocious nubility depends on the race, and not on the influence of a climate excessively warm. It is found on the north-west coast of America, among the Esquimaux, and in Asia, among the Kamtschatdales, and the Koriaks, where girls of ten years old are often mothers. It may appear astonishing, that the time of gesta-
* Bernal Diaz, Hist. Verd. de la Nueva Eıpana, 1630.
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tion-the duration of pregnancy, never alters in a state of health, in any race, or in any climate.

The Chaymas are almost without beard on the chin, like the Tungouses, and other nations of the Mongol race. They pluck out the few hairs which appear; but independently of that practice, most of the natives would be nearly beardless.* I say most of them, because there are tribes which, as they appear distinct from the others, are more worthy of fixing our attention. Such are, in North America, the Chippewas visited by Mackenzie, and the Yabipaees, near the Toltec ruins at Moqui, with bushy beards; in South America, the Patagonians and the Guaraunos. Among these last are some who have hairs on the breast. When the Chaymas, instead of extracting the little hair they have on the chin, attempt to shave themselves frequently, their beards grow. I have seen this experiment tried with success by young Indians, who officiated at mass, and who anxiously wished to resemble the Capuchin fathers, their missionaries and masters. The great mass of the people, however, dislike the beard, no less than the Eastern nations hold it in reverence. This antipathy is derived from the same source as the predilection for flat foreheads, which is evinced in so singular a manner in the statues of the Aztec heroes and divinities. Nations attach the idea of beauty to everything which particularly characterizes their own physical conformation, their national physiognomy. $\dagger$ Hence it ensues that among a people to whom Nature has given very little beard, a narrow forehead, and a brownish red skin, every individual thinks himself handsome in proportion as his body is destitute of hair, his head flattened, and his skin besmeared with annatto, chica, or some other copper-red colour.

The Chaymas lead a life of singular uniformity. They go to rest very regularly at seven in the evening, and rise long before daylight, at half-past four in the morning. Every

[^104]Indian has a fire near his hammock. The women are so chilly, that I have seen them shiver at church when the centigrade thermometer was not below $18^{\circ}$. The huts of the Indians are extremely clean. Their hammocks, their reed mats, their pots for holding cassava and fermented maize, their bows and arrows, everything is arranged in the greatest order. Men and women bathe every day; and being almost constantly unclothed, they are exempted from that uncleanliness, of which the garments are the principal cause among the lower class of people in cold countries. Besides a house in the village, they have generally, in their conucos, near some spring, or at the entrance of some solitary valley, a small hut, covered with the leaves of the palm or plantain-tree. Though they live less commodiously in the conuco, they love to retire thither as often as they can. The irresistible desire the Indians have to flee from society, and enter again on a nomade life, causes even young children sometimes to leave their parents, and wander four or five days in the forests, living on fruits, palm-cabbage, and roots. When travelling in the Missions, it is not uncommon to find whole villages almost deserted, because the inhabitants are in their gardens, or in the forests (al monte). Among civilized nations, the passion for hunting arises perhaps in part from the same causes: the charm of solitude, the innate desire of independence, the deep impression made by Nature, whenever man finds himself in contact with her in solitude.

The condition of the women among the Chaymas, like that in all semi-barbarous nations, is a state of privation and suffering. The hardest labour devolves on them. When we saw the Chaymas return in the evening from their gardens, the man carried nothing but the knife or hatchet (machete), with which he clears his way among the underwood; whilst the woman, bending under a great load of plantains, carried one child in her arms, and sometimes two other children placed upon the load. Notwithstanding this inequality of condition, the wives of the Indians of South America appear to be in general happier than those of the savages of the North. Between the Alleghany mountains and the Mississippi, wherever the natives do not live chiefly on the produce of the chase, the women cultivate maize, beans, and gourds; and the men take no share in the labours of the field. In
the torrid sone, hunting tribes are not numerous, and in the Missions, the men work in the fields as well as the women.

Nothing can exceed the difficulty experienced by the Indians in learning Spanish, to which language they have an absolute aversion. Whilst living separate from the whites, they have no ambition to be called educated Indians, or, to borrow the phrase employed in the Missions, 'latinized Indians' (Indics muy latinos). Not only among the Chaymas, but in all the very remote Missions which I afterwards visited, I observed that the Indians experience vast difficulty in arranging and expressing the most simple ideas in Spanish, even when they perfectly understand the meaning of the words and the turn of the phrases. When a European questions them concerning objects which have surrounded them from their cradles, they seem to manifest an imbecility exceeding that of infancy. The missionaries assert that this embarrassment is neither the effect of timidity nor of natural stupidity, but that it arises from the impediments they meet with in the structure of a language so different from their native tongue. In proportion as man is remote from cultivation, the greater is his mental inaptitude. It is not, therefore, surprising that the isolated Indians in the Missions should experience in the acquisition of the Spanish language, less facility than Indians who live among mestizoes, mulattoes, and whites, in the neighbourhood of towns. Nevertheless, I have often wondered at the volubility with which, at Caripe, the native alcalde, the governador, and the sergento mayor, will harangue for whole hours the Indians assembled before the church; regulating the labours of the week, reprimanding the idle, or threatening the disobedient. Those chiefs who are also of the Chayma race, and who transmit the orders of the missionary, speak all together in a loud voice, with marked emphasis, but almost without action. Their features remain motionless; but their look is imperious and severe.

These same men, who manifest quickness of intellect, and who were tolerably well acquainted with the Spanish, were unable to connect their ideas, when, in our excursions in the country around the convent, we put questions to them through the intervention of the monks. They were made to
affirm or deny whatever the monks pleased: and that wily civility, to which the least cultivated Indian is no stranger, induced them sometimes to give to their answers the turn that seemed to be suggested by our questions. Travellers cannot be enough on their guard against this officious assent, when they seek to confirm their own opinions by the testimony of the natives. To put an Indian alcalde to the proof, I asked him one day, whether he did not think the little river of Caripe, which issues from the cavern of the Guacharo, returned into it on the opposite side by some unknown entrance, after having ascended the slope of the mountain. The Indian seemed gravely to reflect on the subject, and then answered, by way of supporting my hypothesis: "How else, if it were not so, would there always be water in the bed of the river at the mouth of the cavern ?"

The Chaymas are very dull in comprehending anything relating to numerical facts. I never knew one of these people who might not have been made to say that he was either eighteen or sixty years of age. Mr. Marsden observed the same peculiarity in the Malays of Sumatra, though they have been civilized more than five centuries. The Chayma language contains words which express pretty large numbers, yet few Indians know how to apply them; and having felt, from their intercourse with the missionaries, the necessity of so doing, the more intelligent among them count in Spanish, but apparently with great effort of mind, as far as thirty, or perhaps fifty. The same persons, however, cannot count in the Chayma language beyond five or six. It is natural that they should employ in preference the words of a language in which they have been taught the series of units and tens. Since learned Europeans have not disdained to study the structure of the idioms of America with the same care as they study those of the Semitic languages, and of the Greek and Latin, they no longer attribute to the imperfection of a language, what belongs to the rudeness of the nation. It is acknowledged, that almost everywhere the Indian idioms display greater richness, and more delicate gradations, than might be supposed from the uncultivated state of the people by whom they are spoken. I am far from placing the languages of the New World in the same rank with the finest languages of Asia
and Europe; but no one of these latter has a more neat, regular, and simple system of numeration, than the Quichua and the Aztec, which were spoken in the great empires of Cuzco and Anahuac. It is a mistake to suppose that those languages do not admit of counting beyond four, because in villages where they are spoken by the poor labourers of Peruvian and Mexican race, individuals are found, who cannot count beyond that number. The singular opinion, that so many American nations reckon only as far as five, ten, or twenty, has been propagated by travellers, who have not reflected, that, according to the genius of different idioms, men of all nations stop at groups of five, ten, or twenty units (that is, the number of the fingers of one hand, or of both hands, or of the fingers and toes together); and that six, thirteen, or twenty are differently expressed, by five-one, ten-three, and feet-ten.* Can it be said that the numbers of the Europeans do not extend beyond ten, because we stop after having formed a group of ten units?

The construction of the languages of America is so opposite to that of the languages derived from the Latin, that the Jesuits, who had thoroughly examined everything that could contribute to extend their establishments, introduced among their neophytes, instead of the Spanish, some Indian tongues, remarkable for their regularity and copiousness, such as the Quichua and the Guarani. They endeavoured to substitute these languages for others which were poorer and more irregular in their syntax. This substitution was found easy: the Indians of the different tribes adopted it with docility, and thenceforward those American languages generalized became a ready medium of communication between the missionaries and the neophytes. It would be a mistake to suppose, that the preference given to the language of the Incas over the Spanish tongue had no other aim than that of isolating the Missions, and withdrawing them from the influence of two rival powers, the bishops and civil governors. The Jesuits had other motives, independently of their policy, for wishing to generalize certain Indian tongues. They found in those languages a common

[^105].tie, easy to be established between the numerous hordes which had remained hostile to each other, and had been kept asunder by diversity of idioms; for, in uncultivated countries, after the lapse of several ages, dialects often assume the form, or at least the appearance, of mothertongues.

When it is said that a Dane learns the German, and a Spaniard the Italian or the Latin, more easily than they learn any other language, it is at first thought that this facility results from the identity of a great number of roots, common to all the Germanic tongues, or to those of Latin Europe; it is not considered, that, with this resemblance of sounds, there is another resemblance, which acts more powerfully on nations of a common origin. Language is not the result of an arbitrary convention. The mechanism of inflections, the grammatical constructions, the possibility of inversions, all are the offspring of our own minds, of our individual organization. There is in man an instinctive and regulating principle, differently modified among nations not of the same race. A climate more or less severe, a residence in the defiles of mountains, or on the sea-coasts, or different habits of life, may alter the pronunciation, render the identity of the roots obscure, and multiply the number; but all these causes do not affect that which constitutes the structure and mechanism of languages. The influence of climate, and of external circumstances, vanishes before the influence which depends on the race, on the hereditary and individual dispositions of men.

In America (and this result of recent researches* is extremely important with respect to the history of our species) from the country of the Esquimaux to the banks of the Orinoco, and again from these torrid regions to the frozen climate of the Straits of Magellan, mother-tongues, entirely different in their roots, have, if we may use the expression, the same physiognomy. Striking analogies of grammatical construction are acknowledged, not only in the more perfect languages, as in that of the Incas, the Aymara, the Guarauno, the Mexican, and the Cora, but also in languages extremely rude. Idioms, the roots of which do not resemble each other more than the

[^106]roots of the Sclavonic and the Biscayan, have those resemblances of internal mechanism which are found in the Sanscrit, the Persian, the Greek, and the German languages. Almost everywhere in the New World we recognize a multiplicity of forms and tenses in the verb,* an ingenious method of indicating beforehand, either by inflexion of the personal pronouns, which form the terminations of the verb, or by an intercalated suffix, the nature and the relation of its object and its subject, and of distinguishing whether the object be animate or inanimate, of the masculine or the feminine gender, simple or in complex number. It is on account of this general analogy of structure,-it is becaune American languages which have no words in common (for instance, the Mexican and the Quichua), resemble each other by their organization, and form complete contrasts to the languages of Latin Europe, that the Indians of the Missions familiarize themselves more easily with an American idiom than with the Spanish. In the forests of the Orinoco I have seen the rudest Indians speak two or three tongues. Savages of different nations often communicate their ideas to each other by an idiom not their own.

If the system of the Jesuits had been followed, languages, which already occupy a vast extent of country, would have become almost general. In Terra Firma and on the Orinoco, the Caribbean and the Tamanac alone would now be spoken;

[^107]Google
and in the south and south-west, the Quichua, the Guarano, the Omagua, and the Araucan. By appropriating to themselves these languages, the grammatical forms of which are very regular, and almost as fixed as those of the Greek and Sanscrit, the missionaries would place themselves in more intimate connection with the natives whom they govern. The numberless difficulties which occur in the system of a Mission consisting of Indians of ten or a dozen different nations would disappear with the confusion of idioms. Those which are little diffused would become dead languages; but the Indian, in preserving an American idiom, would retain his individuality-his national character. Thus by peaceful means might be effected what the Incas began to establish by force of arms.

How indeed can we be surprised at the little progress made by the Chaymas, the Caribbees, the Salives, or the Otomacs, in the knowledge of the Spanish language, when we recollect that one white man, one single missionary, finds himself alone amidst five or six hundred Indians? and that it is difficult for him to establish among them a goternador, an alcalde, or a fiscal, who may serve him as an interpreter? If, instead of the missionary system, some other means of civilization were substituted, if, instead of keeping the whites at a distance, they could be mingled with the natives recently united in villages, the American idioms would soon be superseded by the languages of Europe, and the natives would receive in those languages the great mass of new ideas which are the fruit of civilization. Then the introduction of general tongues, such as that of the Incas, or the Guaranos, without doubt would become useless. But after having lived so long in the Missions of South America, after having so closely observed the advantages and the abuses of the system of the missionaries, I may be permitted to doubt whether that system could be easily abandoned, though it is doubtless very capable of being improved, and rendered more conformable with our ideas of civil liberty. To this it may be answered, that the Romans* succeeded in rapidly

* For the reason of this rapid introduction of Latin among the Gauls, I believe we must look into the character of the natives and the state of their civilization, and not into the structure of their language. The brown-haired Celtic nations were certainly different from the race of
introducing their language with their sovereignty into the country of the Gauls, into Botica, and into the province of Africa. But the natives of these countries were not savages; -they inhabited towns; they were acquainted with the use of money; and they possessed institutions denoting a tolerably advanced state of cultivation. The allurement of commerce, and a long abode of the Roman legions, had promoted intercourse between them and their conquerors. We see, on the contrary, that the introduction of the languages of the mother-countries was met by obstacles almost innumerable, wherever Carthaginian, Greek, or Roman colonies were established on coasts entirely barbarous. In every age, and in every climate, the first impulse of the savage is to shun the civilized man.

The language of the Chayma Indians was less agreeable to my ear than the Caribbee, the Salive, and other languages of the Orinoco. It has fewer sonorous terminations in accented vowels. We are struck with the frequent repetition of the syllables guaz, ez, puec, and pur. These terminations are derived in part from the inflexion of the verb to $b e$, and from certain prepositions, which are added at the ends of words, and which, according to the genius of the American idioms, are incorporated with them. It would be wrong to attribute this harshness of sound to the abode of the Chaymas in the mountains. They are strangers to that temprate climate. They have been led thither by the missionaries; and it is well known that, like all the inhabitants of warm regions, they at first dreaded what they called the cold of Caripe. I employed myself, with M. Banpland, during our abode at the hospital of the Capuchins, in forming a small catalogue of Chayma words. I am aware that languages are much more strongly characterised by their structure and grammatical forms than by the analogy of their sounds and of their roots; and that the analogy of sounds is sometimes the light-haired Germanic nations; and though the Druid caste recalls to our minds one of the institutions of the Ganges, this does not demonstrate that the idiom of the Celts belongs, like that of the nations of Odin, to a branch of the Indo-Pelasgic languages. From analogy of structure and of roots, the Latin ought to have penetrated more easily on the other side of the Danube, than into Gaul; but an uncultivated state, joined to great moral inflexibility, probably opposed its introduction among the Germanic nations.
so disguised in different dialects of the same tongue, as not to be recognizable; for the tribes into which a nation is divided, often designate the same objects by words altogether heterogeneous. Hence it follows that we readily fall into mistakes, if, neglecting the study of the inflexions, and consulting only the roots (for instance, in the words which designate the moon, sky, water, and earth), we decide on the absolute difference of two idioms from the mere want of resemblance in sounds. But, while aware of this source of error, travellers would do well to continue to collect such materials as may be within their reach. If they do not make known the internal structure, and general arrangement of the edifice, they may point out some important parts.

The three languages now most used in the provinces of Cumana and Barcelona, are the Chayma, the Cumanagota, and the Caribbee. They have always been regarded in these countries as different idioms, and a dictionary of each has been written for the use of the Missions, by Fathers Tauste, Ruiz-blanco, and Breton. The Vocabulario y Arte de la Lengua de los Indios Chaymas has become extremely scarce. The few American grammars, printed for the most part in the seventeenth century, passed into the Missions, and have been lost in the forests. The dampness of the air and the voracity of insects* render the preservation of books almost impossible in those regions: they are destroyed in a short space of time, notwithstanding every precaution that may be employed. I had much difficulty to collect in the Missions, and in the convents, those grammars of American languages, which, on my return to Europe, I placed in the hands of Severin Vater, professor and librarian at the university of Königsberg. They furnished him with useful materials for his great work on the idioms of the New World. I omitted, at the time, to transcribe from my journal, and communicate to that learned gentleman, what I had collected in the Chayma tongue. Since neither Father Gili, nor the Abbé Hervas, has mentioned this language, I shall here explain succinctly the result of my researches.

On the right bank of the Orinoco, south-east of the Mis-

[^108]sion of Encaramada, and at the distance of more than a hundred leagues from the Chaymas, live the Tamanaos (Tamanacu), whose language is divided into several dialects. This nation, formerly very powerful, is separated from the mountains of Caripe by the Orinoco, by the vast steppes of Caracas and of Cumana; and by a barrier far more difficult to surmount, the nations of Caribbean origin. But not withstanding distance, and the numerous obstacles in the way of intercourse, the language of the Chayma Indians is a branch of the Tamanac tongue. The oldest missionaries of Caripe are ignorant of this curious fact, because the Capuchins of Aragon seldom visit the southern banks of the Orinoco, and scarcely know of the existence of the Tamanacs. I recognized the analogy between the idiom of this nation, and that of the Chayma Indians long after my return to Europe, in comparing the materials which I had collected with the sketch of a grammar published in Italy by an old missionary of the Orinoco. Without knowing the Chaymas, the Abbe Gili conjectured that the language of the inhabitants of Paria must have some relation to the Tamanac.*

I will prove this connection by two means which serve to show the analogy of idioms; viz., the grammatical construction, and the identity of words and roots. The following are the personal pronouns of the Chaymas, which are

* Vater has also advanced some well-founded conjectures on the connexion between the Tamanac and Caribbean tongues and those spoken on the north-east coast of South America. I may acquaint the reader, that I have written the words of the American languages according to the Spanish orthography, so that the $u$ should be pronounced oo, the ek like $c h$ in English, \&c. Having during a great number of years spoken no other language than the Castilian, I marked down the sounds according to the orthography of that language, and now I am afraid of changing the value of these signs, by substituting others no less imperfect. It is a barbarous practice, to express, like the greater part of the nations of Europe, the most simple and distinct sounds by many vowels, or many waited consonants, while they might be indicated by letters equally simple. What a chaos is exhibited by the vocabularies written according to English, German, French, or Spanish notations! A new essay, which the illustrious author of the travels in Egypt, M. Volney, is abont to publish on the analysis of sounds found in different nations, and on the notation of thoes soands according to a uniform syatam, will lead to great progress in the study of languages.
at the same time possessive pronouns; u-re, I, me; ou-re, thau, thee; teu-re, he, him. In the Tamanac, u-re, I; amare or anja, thou; iteu-ja, he. The radical of the first and of third person is in the Chayma $u$ and teus.* The same rooks are found in the Tamanac.

| Ure, I.Tuna, water.Conope, rain.tPoturu, to know.Apoto, fire.Nuna, the moon, a month.Je, a tree.Ata, a house.Ruya, to you.Taya, to you.Guane, honey.Nacaramayre, he has said it.Piaehe, a physician, a sorcereTibin, one.Aco, two.Orea, two.Pum, flesh.Pra, no (negation). |  |
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TAMANAC.
Ure.
Trena.
Canepo.
Putura.
Uapto (in Caribbean uato).
Nuna. $\ddagger$
Jeje.
Aute.
Auya.
Itomyan
Uаме.
Nacaramai.
Psiache.
Obin (in Jaoi, Tewin).
Oco (in Caribbean, Occo).
Orua (in Caribbean, Oroa).
Punu.
Pra.

The verb to $b e$, is expressed in Chayma by az. On adding to the verb the personal pronoun $I$ ( $u$ from $u$-re), a $g$ is placed, for the sake of euphony, before the $u$, as in guaz, ' I am,' properly $g$-u-az. As the first person is known by an $u$,

* We must not wonder at those roots which reduce themselves to a single rowel. In a language of the Old Continent, the structure of which is so artificially complicated, (the Biscayan,) the family name Ugarte (between the waters) contains the $u$ of ura (water) and arta between. The $g$ is added for the sake of euphony.
t The same word, conapo, signifies rain and year. The years are counted by the number of winters, or rainy seasons. They say in Chayma, as in Sanscrit, 'so many rains,' meaning so many years. In the Basque language, the word metec, year, is derived from wrten, to bring forth leaves in spring.
$\ddagger$ In the Tamanac and Caribbean languages, Nowo signifies the earth, Nune the moon; as in the Cbayma. This affinity appears to me very curious; and the Indians of the Rio Caurs say, that the moon is 'another earth.' Among savage nations, amidst so many confused ideas, we find certain reminiscences well worthy of attention. Among the Greeslanders Nrue signifies the earth, and Aneningut the moon.
the second is designated by an $m$, the third by an $i$; maz, 'thou art;' muerepuec araquapemaz? 'why art thou sad?' properly. 'what for sad thou art;' punpuec topuchemaz, 'thou art fat in body,' properly 'flesh (pun) for (puec) fat (topuche) thou art (maz).' The possessive pronouns precede the substantive ; upatay, 'in my house,' properly 'my house in.' All the prepositions and the negation pra are incorporated at the end, as in the Tamanac. They say in Chayma, ipuec, ' with him,' properly 'him with;' euya, 'to thee,' or 'thee to;' epuec charpe guaz, 'I am gay with thee,' properly 'thee with gay I am ;' ucarepra, 'not as I,' properly 'I as not;' quenpotupra quoguaz, 'I do not know him,' properly 'him knowing not I am ;' quenepra quoguaz, 'I have not seen him,' properly ' him seeing not I am.' In the Tamanac tongue, acurivane means 'beautiful,' and acurivanepra, 'ugly-not beautiful;' outapra, 'there is no fish,' properly 'fish none;' uteripipra, 'I will not go,' properly 'I to go will not,' composed of uteri," 'to go,' ipiri, 'to choose,' and pra, 'not.' Among the Caribbees, whose language also bears some relation to the Tamanac, though infinitely less than the Chayma, the negation is expressed by an $m$ placed before the verb: amoyenlengati, 'it is very cold;' and mamoyenlengati, 'it is not very cold.' In an analogous manner, the particle mna added to the Tamanac verb, not at the end, but by intercalation, gives it a negative sense, as taro, 'to say,' taromnar, ' not to say.'

The verb to be, very irregular in all languages, is $a z$ or ats in Chayma; and wochiri (in composition uac, uatscha) in Tamanac. It serves not only to form the Passive, but it is added also, as by agglutination, to the radical of attributive verbs, in a number of tenses. $\dagger$ These agglu-

[^109]tinations remind us of the employment in the Sanscrit of the auxiliary verbs as and bhu (asti and bhavati*); the Latin, of es and fu, or fus; $\dagger$ the Biscayan, of izan, ucan, and eguin. There are certain points in which idioms the most dissimilar concur one with another. That which is common in the intellectual organization of man is reflected in the general structure of language; and every idiom, however barbarous it may appear, discloses a regulating principle which has presided at its formation.

The plural, in Tamanac, is indicated in seven different ways, according to the termination of the substantive, or according as it designates an animate or inanimate object. $\ddagger$ In Chayma the plural is formed as in Caribbee, in on; teure, 'himself,' teurecon, 'themselves;' tanorocon, 'those here;' montaonocon, 'those below,' supposing that the interlocutor is speaking of a place where he was himself present; miyonocon, 'those below,' supposing he speaks of a place where he was not present. The Chaymas have also the Castilian adverbs aquí and allá, shades of difference which can be expressed only by periphrasis, in the idioms of Germanic and Latin origin.

Some Indians, who were acquainted with Spanish, assured us, that zis signified not only the sun, but also the Deity. This appeared to me the more extraordinary, as among all other American nations we find distinct words for God and the sun. The Carib does not confound Tamoussicabo, 'the Ancient of Heaven,' with veyou, 'the sun.' Even the Peruvian, though a worshipper of the sun, raises his mind to the idea of a Being who regulates the movements of the stars. The sun, in the language of the Incas, bears
radical 'to carry,' jare (in the infinitive jareri), the result of which is * carrying to be I.'

* In the branch of the Germanic languages we find bhu under the forms bim, bist ; as, in the forms vas, vast, vesum (Bopp, p. 138).
$\dagger$ Hence fu-ero; amav-issem; amav-eram; pos-sum (pot-sum).
$\ddagger$ Tamanacu, 'a Tamanac' (plur. Tamanakemi): Pongheme, a Spaniard (properly 'a man clothed'); Pongamo, Spaniards, or 'men clothed.' The plural in cne characterizes inanimate objects: for example, cene, 'a thing;' cenecne, 'things:' jeje, 'a tree;' jejecne, - trees.'

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the name of inti,* nearly the same as in Sanscrit; while God is called Vinay Huayna, 'the eternally young.' $\dagger$

The arrangement of words in the Chayma is similar to that found in all the languages of both continents, which have preserved a certain primitive character. The object is placed before the verb, the verb before the personal pronoun. The object, on which the attention should be principally fixed, precedes all the modifications of that object. The American would say, 'liberty complete love we,' instead of 'we love complete liberty;' 'Thee with happy am I,' instead of 'I am happy with thee.' There is something direct, firm, demonstrative, in these turns, the simplicity of which is augmented by the absence of the article. May it be presumed that, with advancing civilization, these nations, left to themselves, would have gradually changed the arrangement of their phrases? We are led to adopt this idea, when we reflect on the changes which the syntax of the Romans has undergone in the precise, clear, but somewhat timid languages of Latin Europe.

The Chayma, like the Tamanac and most of the American languages, is entirely destitute of certain letters, as $f, b$, and d. No word begins with an $l$. The same observation has been made on the Mexican tongue, though it is overcharged with the syllables $t l i$, $t l a$, and $i t l$, at the end or in the middle of words. The Chaymas substitute $r$ for $l ;$ a substitution that arises from a defect of pronunciation common in every zone. $\ddagger$ Thus, the Caribbees of the Orinoco have been transformed into Galibi in French Guiana by confounding $r$ with $l$, and softening the $c$. The Tamanac has made choraro and solalo of the Spanish word soldado (soldier). The disappearance of the $f$ and $b$ in so many American idioms arises out of that intimate connection between certain sounds, which is manifested in all lan-

[^110]guages of the same origin. The letters $f, v, b$, and $p$, are substituted one for the other; for instance, in the Persian, peder, father (pater); burader,* brother (frater); behar, spring (ver); in Greek, фóproy (forton), a burthen; noûs (pous) a foot, (fuss, Germ.). In the same manner, with the Americans, $f$ and $b$ become $p$; and $d$ becomes $t$. The Chayma pronounces patre, Tios, Atani, aracapucha, for padre, Dios, Adan, and arcabuz (harquebuss).

In spite of the relations just pointed out, I do not think that the Chayma language can be regarded as a dialect of the Tamanac, as the Maitano, Cuchivero, and Crataima undoubtedly are. There are many essential differences; and between the two languages there appears to me to exist merely the same connection as is found in the German, the Swedish, and the English. They belong to the same subdivision of the great family of the Tamanac, Caribbean, and Arowak tongues. As there exists no absolute measure of resemblance between idioms, the degrees of parentage can be indicated only by examples taken from known tongues. We consider those as being of the same family, which bear affinity one to the other, as the Greek, the German, the Persian, and the Sanscrit.

Some philologists have imagined, on comparing languages, that they may all be divided into two classes, of which some, comparatively perfect in their organization, easy and rapid in their movements, indicate an interior development by inflexion; while others, more rude and less susceptible of improvement, present only a crude assemblage of small. forms or agglutinated particles, each preserving the physiognomy peculiar to itself, when it is separately employed. This very ingenious view would be deficient in accuracy were it supposed that there exist polysyllabic idioms without any inflexion, or that those which are organically developed as by interior germs, admit no external increase by means of suffixes and affixes; $\dagger$ an increase which we have

[^111]already mentioned several times under the name of agglutination or incorporation. Many things, which appear to us at present inflexions of a radical, have perhaps been in their origin affixes, of which there have barely remained one or two consonants. In languages, as in everything in nature that is organized, nothing is entirely isolated or unlike. The farther we penetrate into their internal structure, the more do contrasts and decided characters vanish. It may be said that they are like clouds, the outlines of which do not appear well defined, except when viewed at a distance.

But though we may not admit one simple and absolute principle in the classification of languages, yet it cannot be decided, that in their present state some manifest a greater tendency to inflexion, others to external aggregation. It is well known, that the languages of the Indian, Pelasgic, and German branch, belong to the first division; the American idioms, the Coptic or ancient Egyptian, and to a certain degree, the Semitic languages and the Biscayan, to the second. The little we have made known of the idiom of the Chaymas of Caripe, sufficiently proves that constant tendency towards the incorporation or aggregation of certain forms, which it is easy to separate; though from a somewhat refined sentiment of euphony some letters have been dropped and others have been added. Those affixes, by lengthening words, indicate the most varied relations of number, time, and motion.

When we reflect on the peculiar structure of the American languages, we imagine we discover the source of the opinion generally enteriained from the most remote time in the Missions, that these languages have an analogy with the Hebrew and the Biscayan. At the convent of Caripe as well as at the Orinoco, in Peru as well as in Mexico, I heard this opinion expressed, particularly by monks who had some matical system of languages which are justly cited as models of an interior developement by inflexion. In the grammatical system of the American tongues, for example in the Tamanac, tarecschi, ' I will carry,' is equally composed of the radical ar (infin. jareri, 'to carry') and of the verb ecschi (Infin. nocschiri, 'to be'). There hardly exists in the American languages a triple mode of aggregation, of which we cannot find a similar and analogous example in some other language that is supposed to develope itself only by inflexion.
vague notions of the Semitic languages. Did motives supposed to be favourable to religion, give rise to this extraordinary theory? In the north of America, among the Choctaws and the Chickasaws, travellers somewhat credulous have heard the strains of the Hallelujah* of the Hebrews; as, according to the Pundits, the three sacred words of the mysteries of the Eleusis $\dagger$ ( (onx om pax) resound still in the Indies. I do not mean to suggest, that the nations of Latin Europe may have called whatever has a foreign physiognomy Hebrew or Biscayan, as for a long time all those monuments were called Egyptian, which were not in the Grecian or Roman style. I am rather disposed to think that the grammatical system of the American idioms has confirmed the missionaries of the sixteenth century in their ideas respecting the Asiatic origin of the nations of the New World. The tedious compilation of Father Garcia, Tratado del Origen de los Indios, $\ddagger$ is a proof of this. The position of the possessive and personal pronouns at the end of the noun and the verb, as well as the numerous tenses of the latter, characterize the Hebrew and the other Semitic languages. Some of the missionaries were struck at finding the same peculiarities in the American tongues: they did not reflect, that the analogy of a few scattered features does not prove languages to belong to the same stock.

It appears less astonishing, that men, who are well acquainted with only two languages extremely heterogeneous, the Castilian and the Biscayan, should have found in the latter a family resemblance to the American languages. The composition of words, the facility with which the partial elements are detected, the forms of the verbs, and their different modifications, may have caused and kept up this illusion. But we repeat, an equal tendency towards aggregation or incorporation does not constitute an identity of origin. The following are examples of the relations between the American and Biscayan languages; idioms totally different in their roots.

In Chayma, quenpotupra quoguaz, 'I do not know,' properly, 'knowing not 1 am.' In Tamanac, jarer-uac-ure,

* L'Escarbot, Charlevoix, and even Adair (Hist. of the American Indians, 1775).
+ Asiat. Res., vol. v. Ouvaroff on the Eleusinian Mysteries, 1816. $\ddagger$ Treatise on the Origin of the Indians.
'bearing am I,-I bear'; anarepra aichi, 'he will not bear;' properly, 'bearing not will he'; patcurbe, 'good'; patcutari, 'to make himself good'; Tamanacu, 'a Tamanac'; Tamanacutari, 'to make himself a Tamanac;' Pongheme, 'a Spaniard'; ponghemtari, 'to Spaniardize himself'; tenecchi, 'I will see'; teneiore, 'I will see again'; teccha, 'I go'; tecshare, 'I return'; maypur butke, 'a little Maypure Indian'; aicabotkes, 'a little woman;' maypuritaje, 'an ugly Maypure Indian'; aicataje, 'an ugly woman.'*

In Biscayan: maitetutendot, 'I love him,' properly, 'I loving have him ;' beguia, 'the eye,' and beguitsa, 'to see;' aitagana, 'towards the father:' by adding tu, we form the verb aitaganatu, 'to go towards the father ;' ume-tasuna, 'soft and infantile ingenuity;' wmeqweria, 'disagreeable childishness.'

I may add to these examples some descriptive compounds, which call to mind the infancy of nations, and strike us equally in the American and Biscayan languages, by a certain ingenuousness of expression. In Tamanac, the wasp (uane-imu), 'father (im-de) of honey (uane);' the toes, ptarimucurr, properly, 'the sons of the foot;' the fingers, amgnamисиаru, 'the sons of the hand;' mushrooms, jeje-panari, properly, 'the ears (panari) of a tree (jeje);' the veins of the hand, amgna-mitti, properly, 'the ramified roots;' leaves, prutpe-jareri, properly, 'the hair at the top of the tree;' puirene-veju, properly, the sun (veju), 'straight' or 'perpendicular;' lightning, $\ddagger$ kinemerv-uaptori, properly, 'the fire (uapto) of the thunder,' or ' of the storm.' In Biscayan, becoquia, the forehead, 'what belongs (co and quia) to the eye (beguia);' odotsa, 'the noise (otsa) of the cloud (odoia),' or thunder; arribicia, an echo, properly, 'the animated stone,' from arria, stone, and bicia, life.

The Chayma and Tamanac verbs have an enormous com-

* The diminutive of 'woman' (aica) or of 'Maypure Indian' is formed by adding butke, which is the termination of cujuputke, 'little': taje answers to the accio of the Italians.
+ It may not be unnecessary here to acquaint the reader that honey is produced by an insect of South America, belonging to, or nearly allied, to the wasp genus. This honey, however, possesses noxious qualities which are by some naturalists attributed to the plant Paulinia Australis, the juices of which are collected by the insect.
$\ddagger$ I recognise in kinemeru, 'thander' or 'storm,' the root kineme ' black.'
plication of tenses: two Presents, four Preterites, three Futures. This multiplicity characterises the rudest American languages. Astarloa reckons, in like manner, in the grammatical system of the Biscayan, two hundred and six forms of the verb. Those languages, the principal tendency of which is inflexion, are to the common observer less interesting than those which seem formed by aggregation. In the first, the elements of which words are composed, and which are generally reduced to a few letters, are no longer recognisable: these elements, when isolated, exhibit no meaning; the whole is assimilated and mingled together. The American languages, on the contrary, are like complicated machines, the wheels of which are exposed to view. The mechanism of their construction is visible. We seem to be present at their formation, and we should pronounce them to be of very recent origin, did we not recollect that the human mind steadily follows an impulse once given; that nations enlarge, improve, and repair the grammatical edifice of their languages, according to a plan already determined; finally, that there are countries, whose languages, institutions, and arts, have remained unchanged, we might almost say stereotyped, during the lapse of ages.

The highest degree of intellectual development has been hitherto found among the nations of the Indian and Pelasgic branch. The languages formed principally by aggregation seem themselves to oppose obstacles to the improvement of the mind. They are devoid of that rapid movement, that interior life, to which the inflexion of the root is favourable, and which impart such charms to works of imagination. Let us not, however, forget, that a people celebrated in remote antiquity, a people from whom the Greeks themselves borrowed knowledge, had perhaps a language, the construction of which recals involuntarily that of the languages of America. What a structure of little monosyllabic and dissyllabic forms is added to the verb and to the substantive, in the Coptic language! The semi-barbarous Chayma and Tamanac have tolerably short abstract words to express grandeur, envy, and lightness, cheictivate, uoite, and uonde; but in Coptic, the word malice," metrepherpetou,

[^112]is composed of five elements, easy to be distinguished. This compound signifies 'the quality (met) of a subject (reph), which makes (er) the thing which is (pet), evil (ou).' Nevertheless the Coptic language has had its literature, like the Chinese, the roots of which, far from being aggregated, scarcely approach each other without immediate contact. We must admit that nations once roused from their lethargy, and tending towards civilization, find in the most uncouth languages the secret of expressing with clearness the conceptions of the mind, and of painting the emotions of the soul. Don Juan de la Rea, a highly estimable man, who perished in the sanguinary revolutions of Quito, imitated with graceful simplicity some Idyls of Theocritus in the language of the Incas; and I have been assured, that, excepting treatises on science and philosophy, there is scarcely any work of modern literature that might not be translated into the Peruvian.

The intimate connection established between the natives of the New World and the Spaniards since the conquest, have introduced a certain number of American words into the Castilian language. Some of these words express things not unknown before the discovery of the New World, and scarcely recal to our minds at present their barbarous origin.* Almost all belong to the language of the great Antilles, formerly termed the language of Hayti, of Quizqueja, or of Itis. $\dagger$ I shall confine myself to citing the words maizs, tabaco, canoa, batata, cacique, balsa, conuco, \&c. When the Spaniards, after the year 1498, began to visit the mainland, they already had words $\ddagger$ to designate the vegetable productions most useful
genious reflexions of M. Silvestre de Sacy, in the Notice des Recherches de M. Etienne Quatremère sur la Littérature de l'Egypte.

* For example savannah, and cannibal.
* The word Itis, for Hayti or St. Domingo (Hispaniola), is found in the Itinerarium of Bishop Geraldini (Rome, 1631.)-" Quum Colonus Itim insulam cerneret."
$\ddagger$ The following are Haytian words, in their real form, which have passed into the Castilian language since the end of the 15th ceutury. Many of them are not uninteresting to descriptive botany. Ahi (Capsicum baccatum), batata (Convolvus batatas), bihao (Heliconia bihai), caimito (Chrysophyllum caimito), cahoba (Swietenia mahagoni), jucca and casabi (Jatropha manihot); the word casabi or cassava is employed only for the bread made with the roots of the Jatropha (the name of the plant jucca;
to man, and common both to the islands and to the coasts of Cumana and Paria. Not satisfied with retaining these words borrowed from the Haytians, they helped also to spread them all over America (at a period when the language of Hayti was already a dead language), and to diffuse them among nations who were ignorant even of the existence of the West India Islands. Some words, which are in daily use in the Spanish colonies, are attributed erroneously to the Haytians. Banana is from the Chaconese, the Mbaja language; arepa (bread of manioc, or of the Jatropha manihot) and guayuco (an apron, perizoma) are Caribbee: curiara (a very long boat) is Tamanac: chinchorro (a hammock), and tutuma (the fruit of the Crescentia cujete, or a vessel to contain a liquid), are Chayma words.

I have dwelt thus long on considerations respecting the American tongues, because I am desirous of directing attention to the deep interest attached to this kind of research. This interest is analogous to that inspired by the monuments of semi-barbarous nations, which are examined was also heard by Americo Vespucci on the coast of Paria); age or ajes (Dioscorea alata), copei (Clusia alba), guayacan (Guaiacum officinale), guajaba (Psidium pyriferum), guanavano (Anona muricata), mani (Arachis hypogea), guama (Inga), henequen (was supposed from the erroneous accounts of the first travellers to be an herb with which the Haytians used to cut metals ; it means now every kind of strong thread), hicaco (Chrysobalanus icaco), maghei (Agave Americana), mahiz or maiz (Zea, maize), mamei (Mammea Americana), mangle (Rhizophora), pitahaja (Cactus pitahaja), ceiba (Bombax), tuna (Cactus tuna), hicotea (a tortoise), iguana (Lacerta iguana), manati (Trichecus manati), niyua (Pulex penetrans), hamaca (a hammock), balsa (a raft; however balsa is an old Castilian word signifying a pool of water), barbacoa (a small bed of light wood, or reeds), canei or buhio (a hut), canoa (a canoe), cocujo (Elater noctilucus, the fire-fly), chicha (fermented liquor), macana (a large stick or club, made with the petioles of a palm-tree), tabaco (not the herb, but the pipe through which it is smoked), cacique (a chief). Other American words, now as much in use among the Creoles, as the Arabic words naturalized in the Spanish, do not belong to the Haytian tongue; for example, caiman, piragua, papaja (Carica), aguacate (Persea), tarabita, paramo. Abbé Gili thinks with some probability, that they are derived from the tongue of some people who inhabited the temperate climate between Coro, the mountains of Merida, and the tableland of Bogota. (Saggio, vol. iii., p. 228.) How many Celtic and German words would not Julius Casar and Tacitus have handed down to us, had the productions of the northern couutries visited by the Romans differed as much from the Italian and Roman, as those of equinoctial America!
not becsuse they deserve to be ranked among works of art, but beoause the strady of them throws light on the history of our species, and the progressive development of our faculties.

It now remains for me to speak of the other Indian nations mhabiting the provinces of Cumana and Barcelona. These I shall only succinctly enumerate.
I. The Pariagotos or Parias. It is thought that the terminations in goto, as Pariagoto, Purugoto, Avarigoto, Acherigoto, Cumanagoto, Arinagoto, Kirikirisgoto, ${ }^{*}$ imply a Caribbean origin. $\dagger$ All these tribes, excepting the Purugotos of the Rio Caura, formerly occupied the country which has been so long under the dominion of the Caribbees; namely, the coasts of Berbice and of Essequibo, the peninsula of Paria, the plains of Pirita and Parima. By this last name the little-known country, between the sources of the Cujuni, the Caroni, and the Mao, is designated in the Missions. The Paria Indians are mingled in part with the Chaymas of Cumana; others have been settled by the Capuchins of Aragon in the Missions of Caroni; for instance, at Cupapuy and Alta-Gracia, where they still speak their own language, apparently a dialect between the Tamanac and the Caribbee. But it may be asked, is the name Parias or Pariagotos, a name merely geographical ? Did the Spaniards, who frequented these coasts from their first eatablishment in the island of Cubagua and in Macarapana, give the name of the promontory of Pariat to the tribe by

* The Kirikirisgotos (or Kirikiripas) are of Dutch Guiana. It is very remarkable, that among the small Brazilian tribes who do not speak the language of the Tupis, the Kiriris, notwithstanding the enormous distance of 650 leagues, have several Tamanac words.
$\dagger$ In the Tamanac tongue, which is of the same branch as the Caribbean, we find also the termination goto, as in anekiamgoto 'an animal.' Often an analogy in the termination of names, far from showing an identity of race, only indicates that the names of the nations are borrowed from one language.
$\ddagger$ Paria, Uraparia, even Huriaparia and Payra, are the ancient names of the country, written as the first navigators thought they heard them pronounced. It appears to me by no means probable, that the promontory of Paria should derive its name from that of a cacique Uriapori, celebrated for the manner in which he resisted Diego Ordaz in 1530, thirty-two years after Columbus had heard the name of Paria from the mouths of the natives themselves. The Orinoco at its mouth had also the name of Uriapari, Yuyapari, or Iyupari. In all these denominations of a
which it was inhabited? This we will not positively affirm ; for the Caribbees themselves give the name of Caribana to a country which they occupied, and which extended from the Rio Sinu to the gulf of Darien. This is a striking example of identity of name between an American nation and the territory it possessed. We may conceive, that in a state of society, where residence is not long fixed, such instances must be very rare.
II. The Gwaraons or Gu-ara-ena, almost all free and independent, are dispersed in the Delta of the Orinoco, with the variously ramified channels of which they alone are well acquainted. The Caribbees call the Guaraons $U$-ara-v. They owe their independence to the nature of their country; for the missionaries, in spite of their zeal, have not been tempted to follow them to the tree-tops. The Guar raons, in order to raise their abodes above the surface of the waters at the period of the great inundations, support them on the hewn trunks of the mangrove-tree and of the Mauritia palm-tree.* They make bread of the medullary flour of this palm-tree, which is the sago of America. The flour bears the name of yuruma: I have eaten it at the town of St. Thomas, in Guiana, and it was very agreeable to the taste, resembling rather the cassava-bread
great river, of a shore, and of a rainy country, I think I recognise the radical par, signifying water, not only in the languages of these countries, but also in those of nations very distant from one another on the eastern and western coasts of America. The sea, or great water, is in the Caribbean, Maypure, and Braxilian languages, parana: in the Tamanac, parava. In Upper Guiana also the Orinoco is called Parava. In the Peruvian, or Quichua, I find 'rain,' para; ' to rain,' parani. Besides, there is a lake in Peru that has been very anciently called Paria. (Garcia, Origen de los Indios, p. 292.) I have entered into these minute details soncerning the word Paria, because it has recently been supposed that some connection might be traced between this word and the country of the Hindoo caste called the Parias.
*Their manners have been the same from time immemorial. Cardinal Bembo described them at the beginning of the 16th century, "quibnsdam in locis propter paludes incole domus in arboribns ædificant." (Hist. Venet., 1551.) Sir Walter Raleigh, in 1595, speaks of the Guaraons under the names of Araottes, Trivitivas, and Warawites. These were perhaps the names of some tribes, into which the great Guaraonese nation was divided. (Barrère, Essai sur l'Hist. Naturelle de la France Equinoctiale.)
than the sago of India.* The Indians assured me that the trunks of the Mauritia, the tree of life so much vaunted by father Gumilla, do not yield meal in any abundance, unless the palm-tree is cut down just before the flowers appear. Thus too the maguey, + cultivated in New Spain, furnishes a saccharine liquor, the wine (pulque) of the Mexicans, only at the period when the plant shoots forth its long stem. By interrupting the blossoming, nature is obliged to carry elsewhere the saccharine or amylaceous matter, which would accumulate in the flowers of the maguey and in the fruit of the Mauritia. Some families of Guaraons, associated with the Chaymas, live far from their native land, in the Missions of the plains or llanos of Cumana; for instance, at Santa Rosa de Ocopi. Five or six hundred of them voluntarily quitted their marshes, a few years ago, and formed, on the northern and southern banks of the Orinoco, twenty-five leagues distant from Cape Ba rima, two considerable villages, under the names of Zacupana and Imataca. When I made my journey in Caripe, these Indians were still without missionaries, and lived in complete independence. Their excellent qualities as boatmen, their perfect knowledge of the mouths of the Orinoco, and of the labyrinth of branches communicating with each other, give the Guaraons a certain political importance. They favour that clandestine commerce of which the island of Trinidad is the centre. The Guaraons run with extreme address on muddy lands, where the European, the Negro, or other Indians except themselves, would not dare to walk; and it is, therefore, commonly believed, that they are of lighter weight than the rest of the natives. This is also the opinion that is held in Asia of the Burat Tartars. The few Guaraons whom I saw were of middle size, squat, and very muscular. The lightness with which they walk in places newly dried, without sinking in, when even they have no planks tied to their feet, seemed to me the effect of long habit. Though I sailed a considerable time on the Orinoco, I never went so low as its mouth. Future tra-

[^113]Google
vellers, who may visit those marshy regions, will rectify what $I$ have advanced.
III. The Guaiqueries or Guaikeri, are the most able and most intrepid fishermen of these countries. These people alone are well acquainted with the bank abounding with fish, which surrounds the islands of Coche, Margareta, Sola, and Testigos; a bank of more than four hundred square leagues, extending east and west from Maniquarez to the Boca del Draco. The Guaiqueries inhabit the island of Margareta, the peninsula of Araya, and that suburb of Cumana which bears their name. Their language is believed to be a dialect of that of the Guaraons. This would connect them with the great family of the Caribbee nations ; and the missionary Gili is of opinion that the language of the Guaiqueries is one of the numerous branches of the Caribbean tongue.* These affinities are interesting, because they lead us to perceive an ancient connection between nations dispersed over a vast extent of country, from the mouth of the Rio Caura and the sources of the Erevato, in Parima, to French Guiana, and the coasts of Paria. $\dagger$
IV. The Quaquas, whom the Tamanacs call Mapoje, are a tribe formerly very warlike and allied to the Caribbees. It is a curious phenomenon to find the Quaquas mingled with the Chaymas in the Missions of Cumana, for their language, as well as the Atura, of the cataracts of the Orinoco, is a

[^114]dialect of the Salive tongue; and their original abode was on the banks of the Assiveru, which the Spaniards call Cuchivero. They have extended their migrations one humdred leagues to the north-east. I have often heard them mentioned on the Orinoco, above the mouth of the Meta; and, what is very remarkable, it is asserted* that missionary Jesuits have found Quaquas as far distant as the Cordilleras of Popayan. Raleigh enumerates, among the natives of the island of Trinidad, the Salives, a people remarkable for their mild manners; they came from the Orinoco, and settled south of the Quaquas. Perhaps these two nations, which speak almost the same language, travelled together towards the coasts.
V. The Cumanagotos, or, according to the pronunciation of the Indians, Cumanacoto, are now settled westward of Cu mana, in the Missions of Piritu, where they live by cultivating the ground. They number more than twenty-six thousand. Their language, like that of the Palencas, or Palenques, and Guarivas, is between the Tamanac and the Caribbee, but nearer to the former. These are indeed idioms of the same family; but if we are to consider them as simple dialects, the Latin must be also called a dialect of the Greek, and the Swedish a dialect of the German. In considering the affinity of languages one with another, it must not be forgotten that these affinities may be very differently graduated; and that it would be a source of confusion not to distinguish between simple dialects and languages of the same family. The Cumanagotos, the Tamanacs, the Chaymas, the Guaraons, and the Caribbees, do not understand each other, in spite of the frequent analogy of words and of grammatical structure exhibited in their respective idioms. The Cumanagotos inhabited, at the beginning of the sixteenth century, the mountains of the Brigantine and of Parabolata. I am unable to determine whether the Piritus, Cocheymas, Chacopatas, Tomuzas, and Topocuares, now confounded in the same villages with the Cumanagotos, and speaking their language, were originally tribes of the same nation. The Piritus

[^115]take their name from the ravine Pirichucuar, where the small thorny palm-tree,* called piritu, grows in abundance; the wood of this tree, which is excessively hard, and little combustible, serves to make pipes. On this spot the village of La Concepcion de Piritu was founded in 1556; it is the chief settlement of the Cumanagoto Missions, known by the name of the Misiones de Piritu.
VI. The Caribbees (Carives). This name, which was given them by the first navigators, is retained throughout all Spanish America. The French and the Germans have transformed it, I know not why, into Caraïbes. The people call themselves Carina, Calina, and Callinago. I visited some Caribbean Missions in the Llanos,t on returning from my journey to the Orinoco; and I shall merely mention that the Galibes (Curibi of Cayenne), the Tuapocas, and the Cunaguaras, who originally inhabited the plains between the mountains of Caripe (Caribe) and the village of Maturin, the Jaoi of the island of Trinidad and of the province of Cumana, and perhaps also the Guarivas, allies of the Palencas, are all tribes of the great Caribbee nation.

With respect to the other nations whose affinities of language with the Tamanac and Caribbee have been mentioned, they are not necessarily to be considered as of the same race. In Asia, the nations of Mongol origin differ totally in their physical organisation from those of Tartar origin. Such has been, however, the intermixture of these nations, that, according to the able researches of Klaproth, the Tartar languages (branches of the ancient Oigour) are spoken at present by hordes incontestably of Mongol race. Neither the analogy nor the diversity of language suffice to solve the great problem of the filiation of nations; they merely serve to point out probabilities. The Caribbees, properly speaking, those who inhabit the Missions of the Cari, in the llanos of Cumana, the banks

[^116]of the Caura, and the plains to the north-east of the sources of the Orinoco, are distinguished by their almost gigantic size from all the other nations I have seen in the new continent. Must it on this account be admitted, that the Caribbees are an entirely distinct race? and that the Guarsons and the Tamanacs, whose languages have an affinity with the Caribbee, have no bond of relationship with them? I think not. Among the nations of the same family, one branch may acquire an extraordinary development of organization. The mountaineers of the Tyrol and Salzburgh are taller than the other Germanic races; the Samoiedes of the Altai are not so little and squat as those of the sea-coast. In like manner it would be difficult to deny that the Galibis are really Caribbees; and yet, notwithstanding the identity of languages, how striking is the difference in their stature and physical constitution!

Before Cortez entered the capital of Montezuma in 1521, the attention of Europe was fixed on the regions we have just traversed. In depicting the manners of the inhabitants of Paria and Cumana, it was thought that the manners of all the inhabitants of the new continent were described. This remark cannot escape those who read the historians of the Conquest, especially the letters of Peter Martyr of Anghiera, written at the court of Ferdinand the Catholic. These letters are full of ingenious observations upon Christopher Columbus, Leo X, and Luther, and are stamped by noble enthusiasm for the great discoveries of an age so rich in extraordinary events. Without entering into any detail on the manners of the nations which have been so long confounded one with another, under the vague denomination of Cumanians (Cumaneses), it appears to me important to clear up a fact which I have often heard discussed in Spanish America.

The Pariagotos of the present time are of a brown red colour, as are the Caribbees, the Chaymas, and almost all the nations of the New World. Why do the historians of the sixteenth century affirm that the first navigators saw white men with fair hair at the promontory of Paria? Were they of the same race as those Indians of a less tawny hue, whom M. Bonpland and myself saw at Esmeralda, near the sources of the Orinoco? But these Indians had hair as
black as the Otomacs and other tribes, whose complexion is the darkest. Were they albinoes, such as have been found heretofore in the isthmus of Panama? But examples of that degeneration are very rare in the copper-coloured race; and Anghiera, as well as Gomara, speaks of the inhabitants of Paria in general, and not of a few individuals. Both describe them as if they were people of Germanic origin;* they call them ' Whites with light hair;' they even add, that they wore garments like those of the Turks. $\dagger$ Gomara and Anghiera wrote from such oral information as they had been able to collect.

These marvels disappear, if we examine the recital which Ferdinand Columbus drew up from his father's papers. There we find simply, that "the admiral was surprised to

[^117]see the inhabitants of Paria, and those of the island of Trinidad, better made, more civilized (de buena conversacion), and whiter than the natives whom he had previously seen." This certainly did not mean that the Pariagotos are white. The lighter colour of the skin of the natives, and the great coolness of the mornings on the coast of Paria, seemed to confirm the fantastic hypothesis which that great man had framed, respecting the irregularity of the curvature of the earth, and the height of the plains in this region, which he regarded as the effect of an extraordinary swelling of the globe in the direction of the parallels of latitude. Amerigo Vespucci (in his pretended first voyage, apparently written from the narratives of other navigators) compares the natives to the Tartar nations, $\dagger$ not in regard to their colour, but on account of the breadth of their faces, and the general expression of their physiognomy.

But if it be certain, that at the end of the fifteenth century there were on the coast of Cumana a few men with white skins, as there are in our days, it must not thence be concluded, that the natives of the New World exhibit everywhere a similar organization of the dermoidal system. It is not less inaccurate to say, that they are all coppercoloured, than to affirm that they would not have a tawny hue, if they were not exposed to the heat of the sun, or tanned by the action of the air. The natives may be divided into two very unequal portions with respect to numbers; to the first belong the Esquimaux of Greenland, of Labrador, and the northern coast of Hudson's Bay, the inhabitants of Behring's Straits, of the peninsula

[^118]of Alaska, and of Prince William's Sound. The eastern and western branches* of this polar race, the Esquimaux and the Tschougases, though at the vast distance of eight hundred leagues apart, are united by the most intimate analogy of languages. This analogy extends even to the inhabitants of the north-east of Asia; for the idiom of the Tschouktschest at the mouth of the Anadir, has the same roots as the language of the Esquimaux who inhabit the coast of America opposite to Europe. The Tschouktsches are the Esquimaux of Asia. Like the Malays, that hyperborean race reside only on the sea-coasts. They are almost all smaller in stature than the other Americans, and are quick, lively, and talkative. Their hair is almost straight, and black ; but their skin (and this is very characteristic of the race, which I shall designate under the name of Tschou-gaz-Esquimaux) is originally whitish. It is certain that the children of the Greenlanders are born white ; some retain that whiteness; and often in the brownest (the most tanned) the redness of the blood is seen to appear on their cheeks $\ddagger$

The second portion of the natives of America includes all those nations which are not Tschougaz-Esquimaux, beginning from Cook's River to the Straits of Magellan, from the Cgaljachmouzes and the Kinaese of Mount St. Elias, to the Puelches and Tehuelhets of the southern hemisphere. The men who belong to this second branch, are taller, stronger, more warlike, and more taciturn than the others. They present also very remarkable differences in the colour of their skin. In Mexico, Peru, New Grenada, Quito, on the banks of the Orinoco and of the river Amazon, in every part of South America which I have explored, in the plains as well as on the coldest table-lands, the Indian children of two or three months old have the same bronze tint as

[^119]is observed in adults. The idea that the natives may be whites tanned by the air and the sun, could never have occurred to a Spanish inhabitant of Quito, or of the banks of the Orinoco. In the north-east of America, on the contrary, we meet with tribes among whom the children are white, and at the age of virility they acquire the bronze colour of the natives of Mexico and Peru. Michikinakoua, chief of the Miamis, had his arms, and those parts of his body not exposed to the sun, almost white. This difference of hue between the parts covered and not covered is never observed among the natives of Peru and Mexico, even in families who live much at their ease, and remain almost constantly within doors. To the west of the Miamis, on the coast opposite to Asia, among the Kolouches and Tchinkitans* of Norfolk Sound, grown-up girls, when they have washed their skin, display the white hue of Europeans. This whiteness is found also, according to some accounts, among the mountaineers of Chile. $\dagger$

These facts are very remarkable, and contrary to the opinion so generally spread, of the extreme conformity of organization among the natives of America. If we divide them into Esquimaux and non-Esquimaux, we readily admit that this classification is not more philosophical than that of the ancients, who saw in the whole of the habitable world only Celts and Scythians, Greeks, and Barbarians. When, however, our purpose is to group numerous nations, we gain something by proceeding in the mode of exclusion. All we have sought to establish here is, that, in separating the whole race of Tschougaz-Esquimaux, there remain still, among the coppery-brown Americans, other races, the children of which are born white, without our being able to prove, by going back as far as the history of the Conquest, that they have been mingled with European blood. This fact deserves to be cleared up by tra-

* Between $54^{\circ}$ and $58^{\circ}$ of latitude. These white nations have been visited successively by Portlock, Marchand, Baranoff, and Davidoff. The Tchinkitans, or Schinkit, are the inhabitants of the island of Sitka. Vater, Mithridates, vol. iii., p. 2. Marchand, Voyages, vol. ii.
† Molina, Saggio sull Istoria Nat. del Chile, edit. 2, p. 293. May we believe the existence of those blue eyes of the Boroas of Chile and Guayanas of Uruguay, represented to us as nations of the race of Odin? Azara, Voyage, tom. ii.
vellers who may possess a knowledge of physiology, and may have opportunities of examining the brown children of the Mexicans at the age of two years, as well as the white children of the Miamis, and those hordes* on the Orinoco, who, living in the most sultry regions, retain during their whole life, and in the fulness of their strength, the whitish skin of the Mestizoes.

In man, the deviations from the common type of the whole race are apparent in the stature, the physiognomy, or the form of the body, rather than on the colour of the skin. $\dagger$ It is not so with animals, where varieties are found more in colour than in form. The hair of the mammiferous class of animals, the feathers of birds, and even the scales of fishes, change their hue, according to the lengthened influence of light and darkness, and the intensity of heat and cold. In man, the colouring matter seems to be deposited in the epidermis by the roots or the bulbs of the hair : $\ddagger$ and all sound observations prove, that the skin varies in colour from the action of external stimuli on individuals, and not hereditarily in the whole race. The Esquimaux of Greenland and the Laplanders are tanned by the influence of the air; but their children are born white. We will not decide on the changes which nature may have produced in a space of time exceeding all historical tradition. Reason stops short in these natters, when no longer under the guidance of experience and analogy.

All white-skinned nations begin their cosmogony by white men; they allege that the negroes and all tawny people have been blackened or embrowned by the excessive heat of the sun. This theory, adopted by the Greeks,§ though it did not pass without contradiction, $\|$ has been propagated

* These whitish tribes are the Guaycas, the Ojos, and the Maquiritares.
$\dagger$ The circumpolar nations of the two continents are small and squat, though of races entirely different.
$\ddagger$ Adverting to the interesting researches of M. Gaultier, on the organisation of the human skin, John Hunter observes, that in several animals the colorating of the hair is independent of that of the skin.
§ Strabo, liv. xv.
|| Onesicritus, apud Strabonem, lib. xv. Alexander's expedition appears to have contributed greatly to fix the attention of the Greeks on the great question of the influence of climates. They had learned from
even to our own times. Buffon has repeated in prose what Theodectes had expressed in verse two thousand years before: "that nations wear the livery of the climate in which they live." If history had been written by black nations, they would have maintained what even Europeans have recently advanced,* that man was originally black, or of a very tawny colour; and that mankind have become white in some races, from the effect of civilization and progressive debilitation, as animals, in a state of domestication, pass from dark to lighter colours. In plants and in animals, accidental varieties, formed under our own eyes, have become fired, and have been propagated ; $\dagger$ but nothing proves, that in the present state of human organization, the different races of black, yellow, copper-coloured, and white men, when they remain unmixed, deviate considerably from their primitive type, by the influence of climate, of food, and other external agents.

These opinions are founded on the authority of Ullom. $\ddagger$ That learned writer saw the Indians of Chile, of the Andes of Peru, of the burning coasts of Panama, and those of Louisiana, situated in the northern temperate zone. He had
the accounts of travellers, that in Hindostan the nations of the south were of darker colour than those of the north, near the mountains : and they supposed that they were both of the same race.
*See the work of Mr. Prichard, abounding with curious remearch. " Researches into the Physical History of Man, 1815," p. 239.
$\dagger$ For example, the sheep with very short legs, called ancon sheep in Connecticut, and examined by Sir Everard Home. This variety dates only from the year 1791.
$\ddagger$ "The Indians [Americans] are of a copper-colour, which by the action of the sun and the air grows darker. I must remark, that neither heat nor cold produces any sensible change in the colour, so that the Indians of the Cordilleras of Peru are easily confounded with those of the hottest plains; and those who live under the line cannot be distinguished, by their colour, from those who inhabit the fortieth degree of north and south latitude."-Noticias Americanas. No ancient author has so clearly stated the two forms of reasoning, by which we still explain in our days the differences of colour and features among neighbouring nations, as Tacitus. He makes a just distinction between the influence of climate, and hereditary dispositions; and, like a philosopher persuaded of our profound ignorance of the origin of thinge, he leaves the question undecided. "Habitus corporum varii; atque ex eo argumenta, seu durante originis vi, seu procurrentibus in diversa terris, positio coeli corporibus habitum dedit."-Agricola, cap. ii.
the good fortune to live at a period when theories were less numerous; and, like me, he was struck by seeing the natives equally bronzed under the Line, in the cold climate of the Cordilleras, and in the plains. Where differences of colour are observed, they depend on the race. We shall soon find on the burning banks of the Orinoco Indians with a whitish skin. Durans originis vis est.

## Chapter $X$.

Second abode at Cumana.-Earthquakes.-Extraordinary Meteors.
We remained a month longer at Cumana, employing ourselves in the necessary preparations for our proposed visit to the Orinoco and the Rio Negro. We had to choose such instruments as could be most easily transported in narrow boats; and to engage guides for an inland journey of ten months, across a country without communication with the coasts. The astronomical determination of places being the most important object of this undertaking, I felt desirous not to miss the observation of an eclipse of the sum, which was to be visible at the end of October: and in consequence I preferred remaining till that period at Cumana, where the sky is generally clear and serene. It was now too late to reach the banks of the Orinoco before October; and the high valleys of Caracas promised less favourable opportunities, on account of the vapours which accumulate round the neighbouring mountains.

I was, however, near being compelled by a deplorable occurrence, to renounce, or at least to delay for a long time, my journey to the Orinoco. On the 27th of October, the day before the eclipse, we went as usual, to take the air on the shore of the gulf, and to observe the instant of high water, which in those parts is only twelve or thirteen inches. It was eight in the evening, and the breeze was not yet stirring. The sky was cloudy; and during a dead calm it was excessively hot. We crossed the beach which separates the suburb of the Guayqueria Indians from the embarcadero. I heard some one walking behind us, and on turning, I saw a tall man of the colour of the Zambos, naked to the waist.

He held almost over my head a macana, which is a great stick of palm-tree wood, enlarged to the end like a club. I avoided the stroke by leaping towards the left; but M. Bonpland, who walked on my right, was less fortunate. He did not see the Zambo so soon as I did, and received a stroke above the temple, which levelled him with the ground. We were alone, without arms, half a league from any habitation, on a vast plain bounded by the sea. The Zambo, instead of attacking me, moved off slowly to pick up M. Bonpland's hat, which, having somewhat deadened the violence of the blow, had fallen off and lay at some distance. Alarmed at seeing my companion on the ground, and for some moments senseless, I thought of him only. I helped him to raise himself, and pain and anger doubled his strength. We ran toward the Zambo, who, either from cowardice, common enough in people of this caste, or because he perceived at a distance some men on the beach, did not wait for us, but ran off in the direction of the Tunal, a little thicket of cactus and arborescent avicennia. He chanced to fall in running; and M. Bonpland, who reached him first, seized him round the body. The Zambo drew a long knife; and in this unequal struggle we should infallibly have been wounded, if some Biscayan merchants, who were taking the air on the beach, had not come to our assistance. The Zambo seeing bimself surrounded, thought no longer of defence. He again ran away, and we pursued him through the thorny cactuses. At length, tired out, he took shelter in a cow-house, whence he suffered himself to be quietly led to prison.
M. Bonpland was seized with fever during the night; but being endowed with great energy and fortitude, and possessing that cheerful disposition which is one of the most precious gifts of nature, he continued his labours the next day. The stroke of the macana had extended to the top of his head, and he felt its effect for the space of two or three months during the stay we made at Caracas. When stooping to collect plants, he was sometimes seized with giddiness, which led us to fear that an internal abscess was forming. Happily these apprehensions were unfounded, and the symptoms, at first alarming, gradually disappeared. The inhabitants of Cumana showed us the kindest interest. It was ascertained that the Zambo was a native of one of the

Indian villages which surround the great lake of Maracaibo. He had served on board a privateer belonging to the island of St. Domingo, and in consequence of a quarrel with the captain he had been left on the coast of Cumana, when the ship quitted the port. Having seen the signal which we had fixed up for the purpose of observing the height of the tides, he had watched the moment when he could attack us on the beach. But why, after having knocked one of us down, was he satisfied with simply stealing a hat? In an examination he underwent, his answers were so confused and stupid, that it was impossible to clear up our doubts. Sometimes he maintained that his intention was not to rob us; but that, irritated by the bad treatment he had suffered on board the privateer of St. Domingo, he could not resist the desire of attacking us, when he heard us speak French. Justice is so tardy in this country, that prisoners, of whom the jail is full, may remain seven or eight years without being brought to trial; we learnt, therefore, with some satisfaction, that a few days after our departure from Cumana, the Zambo had succeeded in breaking out of the castle of San Antonio.

On the day after this occurrence, the 28th of October, I was, at five in the morning, on the terrace of our house, making preparations for the observation of the eclipse. The weather was fine and serene. The crescent of Venus, and the constellation of the Ship, so splendid from the disposition of its immense nebulm, were lost in the rays of the rising sun. I had a complete observation of the progress and the close of the eclipse. I determined the distance of the horns, or the differences of altitude and azimuth, by the passage over the threads of the quadrant. . The eclipse terminated at $2^{\mathrm{h}} 14^{\prime} 23 \cdot 4^{\prime \prime}$ mean time, at Cumana.

During a few days which preceded and followed the eclipse of the sun, very remarkable atmospherical phenomena were observable. It was what is called in those countries the season of winter; that is, of clouds and small electrical showers. From the 10th of October to the 3rd of November, at nightfall, a reddish vapour arose in the horizon, and covered, in a few minutes, with a veil more or less thick, the azure vault of the sky. Saussure's hygrometer, far from indicating greater humidity, often went back from
$90^{\circ}$ to $83^{\circ}$. The heat of the day was from $28^{\circ}$ to $32^{\circ}$, which for this part of the torrid zone is very considerable. Sometimes, in the midst of the night, the vapours disappeared in an instant; and at the moment when I had arranged my instruments, clouds of brilliant whiteness collected at thi zenith, and extended towards the horizon. On the 18th of October these clouds were so remarkably transparent, that they did not hide stars even of the fourth magnitude. I could distinguish so perfectly the spots of the moon, that it might have been supposed its disk was before the clouds. The latter were at a prodigious height, disposed in bands, and at equal distances, as from the effect of electric re-pulsions:-these small masses of vapour, similar to those I saw above my head on the ridge of the highest Andes, are, in several languages, designated by the name of sheep. When the reddish vapour spread lightly over the sky, the great stars, which in general, at Cumana, scarcely scintillate below $20^{\circ}$ or $25^{\circ}$, did not retain even at the zenith, their steady and planetary light. They scintillated at all altitudes, as after a heavy storm of rain.* It was curious that the vapour did not affect the hygrometer at the surface of the earth. I remained a part of the night seated in a balcony, from which I had a view of a great part of the horizon. In every climate I feel a peculiar interest in fixing my eyes, when the sky is serene, on some great constellation, and seeing groups of vesicular vapours appear and augment; as around a central nucleus, then, disappearing, form themselves anew.

After the 28th of October, the reddish mist became thicker than it had previously been. The heat of the nights

[^120]seemed stifling, though the thermometer rose only to $26^{\circ}$. The breeze, which generally refreshed the air from eight or nine o'clock in the evening, was no longer felt. The atmosphere was burning hot, and the parched and dusty ground was cracked on every side. On the 4th of November, about two in the afternoon, large clouds of peculiar blackness enveloped the high mountains of the Brigantine and the Tataraqual. They extended by degrees as far as the zenith. About four in the afternoon thunder was heard over our heads, at an immense height, not regularly rolling, but with a hollow and often interrupted sound. At the moment of the strongest electric explosion, at $4^{\text {b }} 12^{\prime}$, there were two shocks of earthquake, which followed each other at the interval of fifteen seconds. The people ran into the streets, uttering loud cries. M. Bonpland, who was leaning over a table examining plants, was almost thrown on the floor. I felt the shock very strongly, though I was lying in a hammock. Its direction was from north to south, which is rare at Cumana. Slaves, who were drawing water from a well more than eighteen or twenty feet deep, near the river Manzanares, heard a noise like the explosion of a strong charge of gunpowder. The noise seemed to come from the bottom of the well; a very curious phenomenon, though very common in most of the countries of America which are exposed to earthquakes.

A few minutes before the first shock there was a very violent blast of wind, followed by electrical rain falling in great drops. I immediately tried the atmospherical electricity by the electrometer of Volta. . The small balls separated four lines; the electricity often changed from positive to negative, as is the case during storms, and, in the north of Europe, even sometimes in a fall of snow. The sky remained cloudy, and the blast of wind was followed by a dead calm, which lasted all night. The sunset presented a picture of extraordinary magnificence. The thick veil of clouds was rent asunder, as in shreds, quite near the horizon; the sun appeared at 12 degrees of altitude on a sky of indigo-blue. Its disk was enormously enlarged, distorted, and undulated toward the edges. The clouds were gilded; and fascicles of divergent rays, refleot
ing the most brilliant rainbow hues, extended over the heavens. A great crowd of people assembled in the public square. This celestial phenomenon,-the earthquake,-the thunder which accompanied it,-the red vapour seen during so many days, all were regarded as the effect of the eclipse.

About nine in the evening there was another shock, much slighter than the former, but attended with a subterraneous noise. The barometer was a little lower than usual; but the progress of the horary variations or small atmospheric tides, was no way interrupted. The mercury was precisely at the minimum of height at the moment of the earthquake; it continued rising till eleven in the evening, and sank again till half after four in the morning, conformably to the law which regulates barometrical variations. In the night between the 3 rd and 4th of November the reddish vapour was so thick that I could not distinguish the situation of the moon, except by a beautiful halo of $20^{\circ}$ diameter.

Scarcely twenty-two months had elapsed since the town of Cumana had been almost totally destroyed by an earthquake. The people regard vapours which obscure the horizon, and the subsidence of wind during the night, as infallible prognostics of disaster. We had frequent visits from persons who wished to know whether our instruments indicated new shocks for the next day; and alarm was great and general when, on the 5th of November, exactly at the same hour as on the preceding day, there was a violent gust of wind, attended by thunder, and a few drops of rain. No shock was felt. The wind and storm returned during five or six days at the same hour, almost at the same minute. The inhabitants of Cumana, and of many other places between the tropics, have long since observed that atmospherical changes, which are, to appearance, the most accidental, succeed each other for whole weeks with astonishing regularity. The same phenomenon occurs in summer, in the temperate zone; nor has it escaped the perception of astronomers, who often observe, in a serene sky, during three or four days successively, clouds which have collected at the same part of the firmament, take the same direction, and dissolve at the same height; sometimes before, sometimes
after the passage of a star over the meridian, consequently within a few minutes of the same point of true time.*

The earthquake of the 4th of November, the first I had felt, made the greater impression on me , as it was accompanied with remarkable meteorological variations. It was, moreover, a positive movement upward and downward, and not a shock by undulation. I did not then imagine, that after a long abode on the table-lands of Quito and the coasts of Peru, I should become almost as familiar with the abrupt movements of the ground as we are in Europe with the sound of thunder. In the city of Quito, we never thought of rising from our beds when, during the night, subterraneous rumblings (bramidos), which seem always to come from the volcano of Pichincha, announced a shock, the force of which, however, is seldom in proportion to the intensity of the noise. The indifference of the inhabitants, who bear in mind that for three centuries past their city has not been destroyed, readily communicates itself to the least intrepid traveller. It is not so much the fear of the danger, as the novelty of the sensation, which makes so forcible an impression when the effect of the slightest earthquake is felt for the first time.

From our infancy, the idea of certain contrasts becomes fixed in our minds: water appears to us an element that moves; earth, a motionless and inert mass. These impressions are the result of daily experience; they are connected with everything that is transmitted to us by the senses. When the shock of an earthquake is felt, when the earth which we had deemed so stable is shaken on its old foundations, one instant suffices to destroy long-fixed illusions. It is like awakening from a dream; but a painful awakening. We feel that we have been deceived by the apparent stability of nature; we become observant of the least noise; we mistrust for the first time the soil we have so long trod with confidence. But if the shocks be repeated, if they become frequent during several successive days, the uncertainty quickly disappears. In 1784, the inhabitants of Mexico were accustomed to hear the thunder roll beneath

[^121]their feet;** as it is heard by us in the region of the clouds. Confidence easily spripgs up in the human breast: on the coasts of Peru we become accustomed to the undulations of the ground, as the sailor becomes accustomed to the tossing of the ship, caused by the motion of the waves.

The reddish vapour which at Cumana had spread a mist over the horizon a little before sunset, disappeared after the 7th of November. The atmosphere resumed its former purity, and the firmament appeared, at the zenith, of that doep blue tint peculiar to climates where heat, light, and a great equality of electric charge seem all to promote the most perfect dissolution of water in the air. I observed, on the night of the 7th, the immersion of the second satellite of Jupiter. The belts of the planet were more distinct than I had ever seen them before.

I passed a part of the night in comparing the intensity of the light emitted by the beautiful stars which shine in the southern sky. I pursued this task carefully in both hemispheres, at sea, and during my abode at Lima, at Guayaquil, and at Mexico. Nearly half a century has now elapsed since La Caille examined that region of the sky which is invisible in Europe. The stars near the south pole are usually observed with so little perseverance and attention, that the greatest changes may take place in the intensity of $t$ heir light and their own motion, without astronomers having the slightest knowledge of them. I think I have remarked changes of this kind in the constellation of the Crane and in that of the Ship. I compared, at first with the naked eye, the stars which are not very distant from each other, for the purpose of classing them according to the method pointed out by Herschel, in a paper read to the Royal Society of London in 1796. I afterwards employed diaphragms diminishing the aperture of the telescope, and coloured and colourless glasses placed before the eyo-glass. I moreover made use of an instrument of reo flexion calculated to bring simultaneously two stars into the field of the telescope, after having equalized their light by receiving it with more or fewer rays at pleasure, reflected by the silvered part of the mirror. I admit that these photometric processes are not very precise; but I believo * Los bramidos de Guanazuato.
the last, which perhaps had never before been employed, might be rendered nearly exact, by adding a scale of equal parts to the moveable frame of the telescope of the sextant. It was by taking the mean of a great number of valuations, that I saw the relative intensity of the light of the great stars decrease in the following manner: Sirius, Canopus, a Centauri, Acherner, $\beta$ Centauri, Fomalhaut, Rigel, Procyon, Beteigueuse, $\epsilon$ of the Great Dog, 8 of the Great Dog, $a$ of the Crane, $a$ of the Peacock. These experiments will become more interesting when travellers shall have determined anew, at intervals of forty or fifty years, some of those changes which the celestial bodies seem to undergo, either at their surface or with respect to their distances from our planetary system.

After having made astronomical observations with the same instruments, in our northern climates and in the torrid zone, we are surprised at the effect produced in the latter (by the transparency of the air, and the less extinction of light), on the clearness with which the double stars, the satellites of Jupiter, or certain nebulæ, present themselves. Beneath a sky equally serene in appearance, it would seem as if more perfect instruments were employed; so much more distinct and well defined do the objects appear between the tropics. It cannot be doubted, that at the period when equinoctial America shall become the centre of extensive civilization, physical astronomy will make immense improvements, in proportion as the skies will be explored with excellent glasses, in the dry and hot climates of Cumana, Coro, and the island of Margareta. I do not here mention the ridge of the Cordilleras, because, with the exception of some high and nearly barren plains in Mexico and Peru, the very elevated table-lands, in which the barometric pressure is from ten to twelve inches less than at the level of the sea, have a misty and extremely variable climate. The extreme purity of the atmosphere which constantly prevails in the low regions during the dry season, counterbalances the elevation of site and the rarity of the air on the table-lands. The elevated strata of the atmosphere, when they envelope the ridges of mountains, undergo rapid changes in their transparency.

The night of the 11th of November was cool and ex-
tremely fine. From half after two in the morning, the most extraordinary luminous meteors were seen in the direction of the east. M. Bonpland, who had risen to enjoy the freshness of the air, perceived them first. Thousands of bolides and falling stars succeeded each other during the space of four hours. Their direction was very regular from north to south. They filled a space in the sky extending from due east $30^{\circ}$ to north and south. In an amplitude of $60^{\circ}$ the meteors were seen to rise above the horizon at E.N.E. and at E., to describe arcs more or less extended, and to fall towards the south, after having followed the direction of the meridian. Some of them attained a height of $40^{\circ}$, and all exceeded $25^{\circ}$ or $30^{\circ}$. There was very little wind in the low regions of the atmosphere, and that little blew from the east. No trace of clouds was to be seen. M. Bonpland states that, from the first appearance of the phenomenon, there was not in the firmament a space equal in extent to three diameters of the moon, which was not filled every instant with bolides and falling stars. The first were fewer in number, but as they were of different sizes, it was impossible to fix the limit between these two classes of phenomena. All these meteors left luminous traces from five to ten degrees in length, as often happens in the equinoctial regions. The phosphorescence of these traces, or luminous bands, lasted seven or eight seconds. Many of the falling stars had a very distinct nucleus, as large as the disk of Jupiter, from which darted sparks of vivid light. The bolides seem to burst as by explosion; but the largest, those from $1^{\circ}$ to $1^{\circ} 15^{\prime}$ in diameter, disappeared without scintillation, leaving behind them phosphorescent bands (trabes) exceeding in breadth fifteen or twenty minutes. The light of these meteors was white, and not reddish, which must doubtless be attributed to the absence of vapour and the extreme transparency of the air. For the same reason, within the tropics, the stars of the first magnitude have, at their rising, a light decidedly whiter than in Europe.

Almost all the inhabitants of Cumana witnessed this phenomenon, because they had left their houses before four o'clock, to attend the early morning mass. They did not behold these bolides with indifference; the oldest among
them remembered that the great earthquakes of 1766 were preceded by similar phenomena. The Guaiqueries in the Indian suburb alleged "that the bolides began to appear at one o'clock ; and that as they returned from fishing in the gulf, they had perceived very small falling stars towards the east." They assured us that igneous meteors were extremely rare on those coasts after two o'clock in the morning.

The phenomenon ceased by degrees after four o'clock, and the bolides and falling stars became less frequent; but we still distinguished some to north-east by their whitish light, and the rapidity of their movement, a quarter of an hour after sunrise. This circumstance will appear less extraordinary, when I mention that in broad daylight, in 1788, the interior of the houses in the town of Popayan was brightly illumined by an aërolite of immense magnitude. It passed over the town, when the sun was shining clearly, about one o'clock. M. Bonpland and myself, during our second residence at Cumana, after having observed, on the 26th of September, 1800, the immersion of the first satellite of Jupiter, succeeded in seeing the planet distinctly with the naked eye, eighteen minutes after the disk of the sun had appeared in the horizon. There was a very slight vapour in the east, but Jupiter appeared on an azure sky. These facts bear evidence of the extreme purity and transparency of the atmosphere in the torrid zone. The mass of diffused light is the less, in proportion as the vapours are more perfectly dissolved. The same cause which checks the diffusion of the solar light, diminishes the extinction of that which emanates either from bolides from Jupiter, or from the moon, seen on the second day after its conjunction. The 12th of November was an extremely hot day, and the hygrometer indicated a very considerable degree of dryness for those climates. The reddish vapour clouded the horizon anew, and rose to the height of $14^{\circ}$. This was the last time it appeared that year ; and I must here observe, that it is no less rare under the fine sky of Cumana, than it is common at Acapulco, on the western coast of Mexico.

We did not neglect, during the course of our journey from Caracas to the Rio Negro, to enquire everywhere,
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whether the meteors of the 12th of November had been perceived. In a wild country, where the greater number of the inhabitants sleep in the open air, so extraordinary a phenomenon could not fail to be remarked, unless it had been concealed from observation by clouds. The Capuchin missionary at San Fernando de Apure,* a village situated amid the savannahs of the province of Varinas; the Franciscan monks stationed near the cataracts of the Orinoco and at Maroa, $\dagger$ on the banks of the Rio Negro; had seen numberless falling-stars and bolides illumine the heavens. Maroa is south-west of Cumana, at one hundred and seventy-four leagues distance. All these observers compared the phenomenon to brilliant fireworks; and it lasted from three till six in the morning. Some of the monks had marked the day in their rituals; others had noted it by the proximate festivals of the Church. Unfortunately, none of them could recollect the direction of the meteors, or their apparent height. From the position of the mountains and thick forests which surround the Missions of the Cataracts and the little village of Maroa, I presume that the bolides were still visible at $20^{\circ}$ above the horizon. On my arrival at the southern extremity of Spanish Guiana, at tho little fort of San Carlos, I found some Portuguese, who had gone up the Rio Negro from the Mission of St. Joseph of the Maravitans. They assured me that in that part of Brazil the phenomenon had been perceived at least as far as San Gabriel das Cachoeiras, consequently as far as the equator itself. $\ddagger$

I was forcibly struck by the immense height which these bolides must have attained, to have rendered them visible simultaneously at Cumana, and on the frontiers of Brasil, in a line of two hundred and thirty leagues in length. But what was my astonishment, when, on my return to Europe, I learned that the same phenomenon had been perceived

* N. lat. $7^{\circ} 53^{\prime} 12^{\prime}$; W. long. $70^{\circ} 20^{\prime}$.
$\dagger$ N. lat. $2^{\circ} 42^{\prime} 0^{\prime \prime}$; W. long. $70^{\circ} 21^{\prime}$.
$\ddagger$ A little to the north-west of San Antonio de Castanheiro. I did not meet with any persons who had observed this meteor, at Santa Fé de Bogota, at Popayan, or in the southern hemisphere, at Quito and Peru. Perhaps the state of the atmosphere, so changeable in these western egions, prevented observation.
on an extent of the globe of $64^{\circ}$ of latitude, and $91^{\circ}$ of longitude; at the equator, in South America, at Labrador, and in Germany! I saw accidentally, during my passage from Philadelphia to Bordeaux,* the corresponding observation of Mr. Ellicot (lat. $30^{\circ} 42$ ) ; and upon my return from Naples to Berlin, I read the account of the Moravian missionaries among the Esquimaux, in the Bibliothek of Göttingen.

The following is a succinct enumeration of the facts: 1st. The fiery meteors were seen in the east, and the east-north-east, at $40^{\circ}$ of elevation, from $2^{h}$ to $6^{\text {b }}$ at Cumana (lat. $10^{\circ} 27^{\prime} 52^{\prime \prime}$, long. $66^{\circ} 30^{\prime}$ ); at Porto Cabello (lat. $10^{\circ} 6^{\prime} 52^{\prime \prime}$, long. $67^{\circ} 5^{\prime}$ ); and on the frontiers of Brazil, near the equator, in long. $70^{\circ}$ west of the meridian of Paris. 2nd. In French Guiana (lat. $4^{\circ} 56^{\prime}$, long. $54^{\circ} 35^{\prime}$ ), "the northern part of the sky was suffused with fire. Numberless falling-stars traversed the heavens during the space of an hour and a half, and shed so vivid a light, that those meteors might be compared to the blazing sheaves which shoot out from fireworks." The knowledge of this fact rests upon the highly trustworthy testimony of the Count de Marbais, then living in exile at Cayenne, a victim to his love of justice and of rational, constitutional liberty. 3rd. Mr. Ellicot, astronomer to the United States, having completed his trigonometric operations for the rectification of the limits on the Ohio, being on the 12th of November in the gulf of Florida, in latitude $25^{\circ}$, and longitude $81^{\circ} 50^{\prime}$, saw in all parts of the sky, "as many meteors as stars, moving in all directions. Some appeared to fall perpendicularly; and it was expected every minute that they would drop into the vessel." The same phenomenon was'perceived upon the American continent as far as latitude $30^{\circ} 42^{\prime}$, 4th. In Labrador, at Nain (lat. $56^{\circ} 55^{\prime}$ ), and Hoffenthal (lat. $58^{\circ} 4^{\prime}$ ); in Greenland, at Lichtenau (lat. $61^{\circ} 5^{\prime}$ ), and at New Herrnhut (lat. $64^{\circ} 14^{\prime}$, long. $52^{\circ} 20^{\prime}$ ); the Esquimaux were terrified at the enormous quantity of bolides which fell during twilight at all points of the firmament, and some of which were said to be a foot broad. 5th. In

[^122]$2 \wedge 2$

Germany, Mr. Zeissing, vicar of Ittetsadt, near Weimar (lat. $50^{\circ} 59^{\prime}$, long. $9^{\circ} 1^{\prime}$ east), perceived, on the 12 th of November, between the hours of six and seven in the morning (half-past two at Cumana), some falling-stars which shed a very white light. Soon after, in the direction of south and south-west, luminous rays appeared from four to six feet long; they were reddish, and resembled the luminous track of a sky-rocket. During the morning twilight, between the hours of seven and eight, the sky, in the direction of south-west, was observed from time to time to be brightly illumined by white lightning, running in serpentine lines along the horizon. At night the cold increased and the barometer rose. It is very probable, that the meteors might have been observed more to the east, in Poland and in Russia.*

The distance from Weimar to the Rio Negro is 1800 nautical leagues; and from the Rio Negro to Herrnhut in Greenland, 1300 leagues. Admitting that the same fiery meteors were seen at points so distant from each other, we must suppose that their height was at least 411 leagues. Near Weimar, the appearance like sky-rockets was observed in the south and south-east; at Cumana, in the east and east-north-east. We may therefore conclude, that numberless aërolites must have fallen into the sea, between Africa and South America, westward of the Cape Verd Islands. But since the direction of the bolides was not the same at Labrador and at Cumana, why were they not perceived in the latter place towards the north, as at Cayenne? We can scarcely be too cautious on a subject, on which good observations made in very distant places are still wanting. I am rather inclined to think, that the Chayma Indians of Cumana did not see the same bolides as the Portuguese in Brazil and the missionaries in Labrador ; but at the same time it cannot be doubted (and this fact appears to me very, remarkable) that in the New World, between the meridians of $46^{\circ}$ and $82^{\circ}$, between the equator and $64^{\circ}$ north, at the same hour, an

[^123]immense number of bolides and falling-stars were perceived; and that those meteors had everywhere the same brilliancy, throughout a space of 921,000 square leagues.

Astronomers who have lately been directing minute attention to falling-stars and their parallaxes, consider them as meteors belonging to the farthest limits of our atmosphere, between the region of the Aurora Borealis and that of the lightest clouds.* Some have been seen, which had not more than 14,000 toises, or about five leagues of elevation. The highest do not appear to exceed thirty leagues. They are often more than a hundred feet in diameter : and their swiftness is such, that they dart in a few seconds through a space of two leagues. Of some which have been measured, the direction was almost perpendicularly upward, or forming an angle of $50^{\circ}$ with the vertical line. This extremely remarkable circumstance has led to the conclusion, that falling-stars are not aërolites which, after having hovered a long time in space, unite on accidentally entering into our atmosphere, and fall towards the earth. $\dagger$

Whatever may be the origin of these luminous meteors, it is difficult to conceive an instantaneous inflammation taking place in a region where there is less air than in the vacuum of our air-pumps; and where (at the height of 25,000 toises) the mercury in the barometer would not rise to 0.012 of a line. We have ascertained the uniform mixture of atmospheric air to be about 0.003 , only to an elevation of 3000 toises; consequently not beyond the last stratum of fleecy clouds. It may be admitted that, in the first revolutions of the globe, gaseous substances, which yet remain unknown to us, have risen towards that region through which the falling-stars pass; but accurate experiments, made upon mixtures of gases which have not the same specific gravity, show that there is no reason for supposing a superior stratum of the atmosphere entirely different from the inferior strata. Gaseous substances mingle and penetrate each other on the

[^124]least movement; and a uniformity of their mixture may have taken place in the lapse of ages, unless we believe them to possess a repulsive action of which there is no example in those substances we can subject to our observations. Farther, if we admit the existence of particular aërial fluids in the inaccessible regions of luminous meteors, of falling-stars, bolides, and the Aurora Borealis; how can we conceive why the whole stratum of those fluids does not at once ignite, but that the gaseous emanations, like the clonds, occupy only limited spaces? How can we suppose an electrical explosion without some vapours collected together, capable of containing unequal charges of electricity, in air, the mean temperature of which is perhaps $25^{\circ}$ below the freering point of the centigrade thermometer, and the rarefaction of which is so considerable, that the compression of the electrical shock could scarcely disengage any heat? These difficulties would in great part be removed, if the direction of the movement of falling-stars allowed us to consider them as bodies with a solid nucleus, as cosmic phenomena (belonging to space beyond the limits of our atmosphere), and not as telluric phenomena (belonging to our planet only):

Supposing the meteors of Cumana to have been only at the usual height at which falling-stars in general move, the same meteors were seen above the horizon in places more than 310 leagues distant from each other.* How great a disposition to incandescence must have prevailed on the 12th November, in the higher regions of the atmosphere, to have rendered during four hours myriads of bolides and falling stars visible at the equator, in Greenland, and in Germany!
M. Benzenberg observes, that the same cause which renders the phenomenon more frequent, has also an influence on the large size of the meteors, and the intensity of their light. In Europe, the greatest number of falling stars are seen on those nights on which very bright ones are mingled with very small ones. The periodical nature of the phenomenon augments the interest it excites. There are months in which M. Brandes has reckoned in our temperate zone only sixty or eighty falling-stars in one night; and in other months

* It was this circumstance that induced Lambert tn propose the observation of falling-stars for the determination of terrestrial longitudes. He considered them to be celestial signals seen at great distances.
their number has risen to two thousand. Whenever one is observed, which has the diameter of Sirius or of Jupiter, we are sure of seeing the brilliant meteor succeeded by a great number of smaller ones. If the falling stars be very numerous during one night, it is probable that they will continue equally so during several weeks. It would seem, that in the higher regions of the atmosphere, near that extreme limit where the centrifugal force is balanced by gravity, there exists at regular periods a particular disposition for the production of bolides, falling-stars, and the Aurora Borealis.* Does the periodical recurrence of this great phenomenon depend upon the state of the atmosphere? or upon something which the atmosphere receives from without, while the earth advances in the ecliptic? Of all this we are still as ignorant as mankind were in the days of Anaxagoras.

With respect to the falling-stars themselves, it appears to me, from my own experience, that they are more frequent in the equinoctial regions than in the temperate zone; and more frequent above continents, and near certain coasts, than in the middle of the ocean. Do the radiation of the surface of the globe, and the electric charge of the lower regions of the atmosphere (which varies according to the nature of the soil and the positions of the continents and seas), exert their influence as far as those heights where eternal winter reigns? The total absence of even the smallest clouds, at certain seasons, or above some barren plains destitute of vegetation, seems to prove that this.influence can be felt as far as five or six thousand toises high.

A phenomenon analogous to that which appeared on the 12th of November at Cumana, was observed thirty years previously on the table-land of the Andes, in a country studded with volcanoes. In the city of Quito there was seen in one part of the sky, above the volcano of Cayamba, such great numbers of falling-stars, that the mountain was thought to be in flames. This singular sight lasted more than an hour. The people assembled in the plain of Exido,

[^125]which commands a magnificent view of the highest summits of the Cordilleras. A procession was on the point of setting out from the convent of San Francisco, when it was perceived that the blaze on the horizon was caused by fiery meteors, which ran along the skies in all directions, at the altitude of twelve or thirteen degrees.

## Chapter XI.

## Passage from Cumana to La Guayra.-Morro of New Barcelona.-Cape Codera.-Road from La Guayra to Caracas.

On the 16th of November, at eight in the evening, we were under sail to proceed along the coast from Cumana to the port of La Guayra, whence the inhabitants of the province of Venezuela export the greater part of their produce. The passage is only a distance of sixty leagues, and it usually occupies from thirty-six to forty hours. The little coasting vessels are favoured at once by the wind and by the currents, which run with more or less force from east to west, along the coasts of Terra Firma, particularly from cape Paria to the cape of Chichibacoa. The road by land from Cumans to New Barcelona, and thence to Caracas, is nearly in the same state as that in which it was before the discovery of America. The traveller has to contend with the obstacles presented by a miry soil, large scattered rocks, and strong vegetation. He must sleep in the open air, pass through the valleys of the Unare, the Tuy, and the Capaya, and cross torrents which swell rapidly on account of the proximity of the mountains. To these obstacles must be added the dangers arising from the extreme insalubrity of the country. The very low lands, between the sea-shore and the chain of hills nearest the coast, from the bay of Mochima as far as Coro, are extremely unhealthy. But the last-mentioned town, which is surrounded by an immense wood of thorny cactuses, owes its great salubrity, like Cumana, to its barren soil and the absence of rain.

In returning from Caracas to Cumana, the road by land is
sometimes preferred to the passage by sea, to avoid the adverse current. The postman from Caracas is nine days in performing this journey. We often saw persons, who had followed him, arrive at Cumana ill of nervous and miasmatic fevers. The tree of which the bark* furnishes a salutary remedy for those fevers, grows in the same valleys, and upon the edge of the same forests which send forth the pernicious exhalations. M. Bonpland recognised the cuspare in the vegetation of the gulf of Santa Fé, situated between the ports of Cumana and Barcelona. The sickly traveller may perchance repose in a cottage, the inhabitants of which are ignorant of the febrifuge qualities of the trees that shade the surrounding valleys.

Having proceeded by sea from Cumana to La Guayra, we intended to take up our abode in the town of Caracas, till the end of the rainy season. From Caracas we proposed to direct our course across the great plains or llanos, to the Missions of the Orinoco; to go up that vast river, to the south of the cataracts, as far as the Rio Negro and the frontiers of Brazil; and thence to return to Cumana by the capital of Spanish Guiana, commonly called, on account of its situation, Angostura, or the Strait. We could not determine the time we might require to accomplish a tour of seven hundred leagues, more than two-thirds of that distance having to be traversed in boats. The only parts of the Orinoco known on the coasts are those near its mouth. No commercial intercourse is kept up with the Missions. The whole of the country beyond the llanos is unknown to the inhabitants of Cumana and Caracas. Some think that the plains of Calabozo, covered with turf, stretch eight hundred leagues southward, communicating with the Steppes or Pampas of Buenos Ayres; others, recalling to mind the great mortality which prevailed among the troops of Iturriaga and Solano, during their expedition to the Orinoco, consider the whole country, south of the cataracts of Atures, as extremely pernicious to health. In a region where travelling is so uncommon, people seem to feel a pleasure in'exaggerating to strangers the difficulties arising from the climate, the wild animals, and the Indians. Nevertheless we persisted in the project we

* Cortex Angosturæ of our pharmacopæias, the bark of the Bonplandia trifoliata.
had formed. We could rely upon the intereat and solicitude of the governor of Camana, Don Vicente Emparan, as well as on the recommendations of the Franciscan monks, who are in reality masters of the shores of the Orinoco.

Fortunately for us, one of those monks, Juan Gonzales, was at that time in Cumana. This young monk, who was only a lay-brother, was highly intelligent, and full of spirit and courage. He had the misfortune shortly after his arrival on the coast to displease his superiors, upon the election of a new director of the Missions of Piritu, which is a period of great agitation in the convent of New Barcelona. The triumphant party exercised a general retaliation, from which the lay-brother could not escape. He was sent to Esmeralda, the last Mission of the Upper Orinoco, famous for the vast quantity of noxious insects with which the air is continually filled. Fray Juan Gonzales was thoroughly acquainted with the forests which extend from the cataracts towards the sources of the Orinoco. Another revolution in the republican government of the monks bad some years before brought him to the coast, where he enjoyed (and most justly) the esteem of his superiors. He confirmed us in our desire of examining the much-disputed bifurcation of the Orinoco. He gave us useful advice for the preservation of our health, in climates where he had himself suffered long from intermitting fevers. We had the satisfaction of finding Fray Juan Gonzales at New Barcelona, on our return from the Rio Negro. Intending to go from the Havannah to Cadiz, he obligingly offered to take charge of part of our herbals, and our insects of the Orinoco; but these collections were unfortunately lost with himself at sea. This excellent young man, who was much attached to us, and whose zeal and courage might have rendered him very serviceable to the missions of his order, perished in a storm on the coast of Africa, in 1801.

The boat which conveyed us from Cumana to La Guayra, was one of those employed in trading between the coasts and the West India Islands. They are thirty feet long, and not more than three feet high at the gunwale; they have no decks, and their burthen is generally from two hundred to two hundred and fifty quintals. Although the sea is extremely rough from Cape Codera to La Guayra, and although
the boats have an enormous triangular sail, somewhat dangerous in those gusts which issue from the mountain-passes; no instance has occurred during thirty years, of one of these boats being lost in the passage from Cumana to the coast of Caracas. The skill of the Guaiqueria pilots is so great, that accidents are very rare, even in the frequent trips they make from Cumana to Guadaloupe, or the Danish islands, which are surrounded with breakers. These voyages of 120 or 150 leagues, in an open sea, out of sight of land, are performed in boats without decks, like those of the ancients, without observations of the meridian altitude of the sun, without charts, and generally without a compass. The Indian pilot directs his course at night by the pole-star, and in the daytime by the sun and the wind. I have seen Guaiqueries and pilots of the Zambo caste, who could find the pole-star by the direction of the pointers $a$ and $\beta$ of the Great Bear, and they seemed to me to steer less from the view of the pole-star itself, than from the line drawn through these stars. It is surprising, that at the first sight of land, they can find the island of Guadaloupe, Santa Cruz, or Porto Rico; but the compensation of the errors of their course is not always equally fortunate. The boats, if they fall to leeward in making land, beat up with great difficulty to the eastward, against the wind and the current.

We descended rapidly the little river Manzanares, the windings of which are marked by cocoa-trees, as the rivers of Europe are sometimes bordered by poplars and old willows. On the adjacent arid land, the thorny bushes, on which by day nothing is visible but dust, glitter during the night with thousands of luminous sparks. The number of phosphorescent insects augments in the stormy season. The traveller in the equinoctial regions is never weary of admiring the effect of those reddish and moveable fires, which, being reflected by limpid water, blend their radiance with that of the starry vault of heaven.

We quitted the shore of Cumana as if it had long been our home. This was the first land we had trodden in a zone, towards which my thoughts had been directed from earliest youth. There is a powerful charm in the impression produced by the scenery and climate of these regions; and after an abode of a few months we seemed to have lived there
during a long succession of years. In Europe, the inhabitant of the north feels an almost similar emotion, when he quits even after a short abode the shores of the Bay of Naples, the delicious country between Tivoli and the lake of Nemi, or the wild and majestic scenery of the Upper Alps and the Pyrenees. Yet everywhere in the temperate zone, the effects of vegetable physiognomy afford little contrast. The firs and the oaks which crown the mountains of Sweden have a certain family air in common with those which adorn Greece and Italy. Between the tropics, on the contrary, in the lower regions of both Indies, everything in nature appears new and marvellous. In the open plains and amid the gloom of forests, almost all the remembrances of Europe are effaced; for it is vegetation that determines the character of a landscape, and acts upon the imagination by its mass, the contrast of its forms, and the glow of its colours. In proportion as impressions are powerful and new, they weaken antecedent impressions, and their force imparts to them the character of duration. I appeal to those who, more sensible to the beauties of nature than to the charms of society, have long resided in the torrid zone. How dear, how memorable during life, is the land on which they first disembarked! A vague desire to revisit that spot remains rooted in their minds to the most advanced age. Cumana and its dusty soil are still more frequently present to my imigination, than all the wonders of the Cordilleras. Beneath the bright sky of the south, the light, and the magic of the aërial hues, embellish a land almost destitute of vegetation. The sun does not merely enlighten, it colours the objects, and wraps them in a thin vapour, which, without changing the transparency of the air, renders its tints more harmonious, softens the effects of the light, and diffuses over nature a placid calm, which is reflected in our souls. To explain this vivid impression which the aspect of the scenery in the two Indies produces, even on coasts but thinly wooded, it is sufficient to recollect that the beauty of the sky augments from Naples to the equator, almost as much as from Provence to the south of Italy.

We passed at high water the bar formed at the mouth of the little river Manzanares. The evening breeze gently swelled the waves in the gulf of Cariaco. The moon had
not risen, but that part of the milky way which extends from the feet of the Centaur towards the constellation of Sagittarius, seemed to pour a silvery light over the surface of the ocean. The white rock, crowned by the castle of San Antonio, appeared from time to time between the high tops of the cocoa-trees which border the shore; and we soon recognized the coasts only by the scattered lights of the Guaiqueria fishermen.

We sailed at first to N. N. W., approaching the peninsula of Araya; we then ran thirty miles to W. and W.S.W. As we advanced towards the shoal that surrounds Cape Arenas and stretches as far as the petroleum springs of Maniquarez, we enjoyed one of those varied sights which the great phosphorescence of the sea so often displays in those climates. Bands of porpoises followed our bark. Fifteen or sixteen of these animals swam at equal distances from each other. When turning on their backs, they struck the surface of the water with their broad tails; they diffused a brilliant light, which seemed like flames issuing from the depth of the ocean.* Each band of porpoises, ploughing the surface of the waters, left behind it a track of light, the more striking as the rest of the sea was not phosphorescent. As the motion of an oar, and the track of the bark, produced on that night but feeble sparks, it is natural to suppose that the vivid phosphorescence caused by the porpoises was owing not only to the stroke of their tails, but also to the gelatinous matter that envelopes their bodies, and is detached by the shock of the waves.

We found ourselves at midnight between some barren and rocky islands, which uprise like bastions in the middle of the sea, and form the group of the Caracas and Chimanas. $\dagger$ The moon was above the horizon, and lighted up these cleft rocks which are bare of vegetation and of fantastic aspect. The sea here forms a sort of bay, a slight inward curve of the land between Cumana and Cape Codera. The islets of Picua, Picuita, Caracas, and Boracha, appear like fragments of the ancient coast, which stretches from Bordones in the same direction east and west. The gulfs of Mochima and Santa Fé, which will no doubt one day become frequented

[^126]ports, lie behind those little islands. The rents in the land, the fracture and dip of the strata, all here denote the effects of a great revolution: possibly that which clove asunder the chain of the primitive mountains, and separated the micaschist of Araya and the island of Margareta from the gneiss of Cape Codera. Several of the islands are visible at Cumana, from the terraces of the houses, and they produce, according to the superposition of layers of air more or less heated, the most singular effects of suspension and mirage. The height of the rocks does not probably exceed one hundred and fifty toises ; but at night, when lighted by the moon, they seem to be of a very considerable elevation.

It may appear extraordinary, to find the Caracas Islands so distant from the city of that name, opposite the coast of the Cumanagotos; but the denomination of Caracas denoted at the beginning of the Conquest, not a particular spot, but a tribe of Indians, neighbours of the Tecs, the Taramaynas, and the Chagaragates. As we came very near this group of mountainous islands, we were becalmed; and at sunrise, small currents drifted us toward Boracha, the largest of them. As the rocks rise nearly perpendicular, the shore is abrupt; and in a subsequent voyage 1 saw frigates at anchor almost touching the land. The temperature of the atmosphere became sensibly higher whilst we were sailing among the islands of this little archipelago. The rocks, heated during the day, throw out at night, by radiation, a part of the heat absorbed. As the sun arose on the horizon, the rugged mountains projected their vast shadows on the surface of the ocean. The flamingoes began to fish in places where they found in a creek calcareous rocks bordered by a narrow beach. All these islands are now entirely uninhabited; but upon one of the Caracas are found wild goats of large size, brown, and extremely swift. Our Indian pilot assured as that their flesh has an excellent flavour. Thirty years ago a family of whites settled on this island, where they cultivated maize and cassava. The father alone survived his children. As his wealth increased, he purchased two black slaves; and by these slaves he was murdered. The goats became wild, but the cultivated plants perished. Maize in America, like wheat in Europe, connected with man since his first migrations, appears to be preserved only by his care. We some-
times see these nutritive gramina disseminate themselves; but when left to nature the birds prevent their repnoduction by destroying the seeds.
We anchored for some hours in the road of New Barcelona, at the mouth of the river Neveri, of which the Indian (Cumanagoto) name is Enipiricuar. This river is full of crocodiles, which sometimes extend their excursions into the open sea, especially in calm weather. They are of the species common in the Orinoco, and bear so much resemblance to the crocodile of Egypt, that they have long been confounded together. It may easily be conceived that an animal, the body of which is surrounded with a kind of armour, must be nearly indifferent to the saltness of the water. Pigafetta relates in his journal recently published at Milan that he saw, on the shores of the island of Borneo, crocodiles which inhabit alike land and sea. These facts must be interesting to geologists, since attention has been fixed on the fresh-water formations, and the curious mixture of marine and fluviatile petrifactions sometimes observed in certain very recent rocks.

The port of Barcelona has maintained a very active commerce since 1795. From Barcelona is exported most of the produce of those vast steppes which extend from the south side of the chain of the coast as far as the Orinoco, and in which cattle of every kind are almost as abundant as in the Pampas of Buenos Ayres. The commercial industry of these countries depends on the demand in the West India Islands for salted provision, oxen, mules, and horses. The coasts of Terra Firma being opposite to the island of Cuba, at a distance of fifteen or eighteen days' sail, the merchants of the Havannah prefer, especially in time of peace, obtaining their provision from the port of Barcelona, to the risk of a long voyage in another hemisphere to the mouth of the Rio de la Plata. The situation of Barcelona is singularly advantageous for the trade in cattle. The animals have only three days' journey from the llanos to the port, while it requires eight or nine days to reach Cumana, on acoount of the chain of mountains of the Brigantine and the Imposible.

Having landed on the right bank of the Neveri, we ascended to a little fort called El Morro de Barcelona, situated at the elevation of sixty or seventy toises above the level of
the sea. The Morro is a calcareous rock which has been lately fortified.

The view from the summit of the Morro is not without beauty. The rocky island of Boracha lies on the east, the lofty promontory of Unare is on the west, and below are seen the mouth of the river Neveri, and the arid shores on which the crocodiles come to sleep in the sun. Notwithstanding the extreme heat of the air, for the thermometer, exposed to the reflection of the white calcareous rock, rose to $38^{\circ}$, we traversed the whole of the eminence. A fortunate chance led us to observe some very curious geological phenomena, which we again met with in the Cordilleras of Mexico. The limestone of Barcelona has a dull, even, or conchoidal fracture, with very flat cavities. It is divided into very thin strata, and exhibits less analogy with the limestone of Cumanacoa, than with that of Caripe, forming the cavern of the Guacharo. It is traversed by banks of schistose jasper,* black, with a conchoidal fracture, and breaking into fragments of a parallelopipedal figure. This fossil does not exhibit those little streaks of quartz so common in the Lydian stone. It is found decomposed at its surface into a yellowish grey crust, and it does not act upon the magnet. Its edges, a little translucid, give it some resemblance to the hornstone, so common in secondary limestones. $\dagger$ It is remarkable that we find the schistose jasper which in Europe characterizes the transition rocks, $\ddagger$ in a limestone having great analogy with that of Jura. In the study of formations, which is the great end of geognosy, the knowledge acquired in the old and new worlds should be made to furnish reciprocal aid to each other. It appears that these black strata are found also in the calcareous mountains of the island of Boracha.§ Another jasper, that known by the name of the Egyptian pebble, was found by M. Bonpland near the Indian village of Curacatiche or

[^127]Curacaguitiche, fifteen leagues south of the Morro of Barcelona, when, on our return from the Orinoco, we crossed the llanos, and approached the mountains on the coast. This stone presented yellowish concentric lines and bands, on a reddish brown ground. It appeared to me that the round pieces of Egyptian jasper belonged also to the Barcelona limestone. Yet, according to M. Cordier, the fine pebbles of Suez owe their origin to a breccia formation, or siliceous agglomerate.

At the moment of our setting sail, on the 19th of November, at noon, I took some altitudes of the moon, to determine the longitude of the Morro. The difference of meridian between Cumana and the town of Barcelona, where I made a great number of astronomical observations in 1800, is $34^{\prime \prime} 48^{\prime \prime}$. I found the dip of the needle $42 \cdot 20^{\circ}$ : the intensity of the forces was equal to 224 oscillations.

From the Morro of Barcelona to Cape Codera, the land becomes low, as it recedes southward; and the soundings extend to the distance of three miles. Beyond this we find the bottom at forty-five or fifty fathoms. The temperature of the sea at its surface was $25.9^{\circ}$; but when we were passing through the narrow channel which separates the two Piritu Islands, in three fathoms water, the thermometer was only $24: 5^{\circ}$. The difference would perhaps be greater, if the current, which runs rapidly westward, stirred up deeper water; and if, in a pass of such small width, the land did not contribute to raise the temperature of the sea. The Piritu Islands resemble those shoals which become visible when the tide falls. They do not rise more than eight or nine inches above the mean height of the sea. Their surface is smooth, and covered with grass. We might have thought we were gazing on some of our own northern meadows. The disk of the setting sun appeared like a globe of fire suspended over the savannah; and its last rays, as they swept the earth, illumined the grass, which was at the same time agitated by the evening breeze. In the low and humid parts of the equinoctial zone, even when the gramineous plants and reeds present the aspect of a meadow, a rich accessory of the picture is usually wanting; I allude to that variety of wild flowers, which, vox. 1. 2 в
scarcely rising above the grass, seem as it were, to lie upon a smooth bed of verdure. Within the tropics, the strength and luxury of vegetation give such a development to plants, that the smallest of the dicotyledonous family become shrubs. It would seem as if the liliaceous plants, mingling with the gramina, assumed the place of the flowers of our meadows. Their form is indeed striking; they dazzle by the variety and splendour of their colours; but being too high above the soil, they disturb that harmonious proportion which characterizes the plants of our European meadows. Nature has in every zone stamped on the landscape the peculiar type of beauty proper to the locality.

We must not be surprised that fertile islands, so near Terra Firma, are not now inhabited. It was only at the early period of the discovery, and whilst the Caribbees, Chaymas, and Cumanagotos were still masters of the coast, that the Spaniards formed settlements at Cubagua and Margareta. When the natives were subdued, or driven southward in the direction of the savannahs, the preference was given to settlements on the continent, where there was a choice of land, and where there were Indians, who might be treated like beasts of burden. Had the little islands of Tortuga, Blanquilla, and Orchills been situated in the group of the Antilles, they would not have remained without traces of cultivation.

Vessels of heary burthen pass between the main land and the most sauthern of the Piritu Islands. Being very low, their northern point is dreaded by pilots who near the coast in those latitudes. When we found ourselves to westward of the Morro of Barcelons, and the mouth of the river Unare, the sea, till then calm, became agitated and rough in proportion as we approached Cape Codera. The influence of that vast promontory is felt from afar, in that part of the Caribbean Sea. The length af the passage from Cumana to La Guayra depends on the degree of ease or difficulty with which Cape Codera can be doubled. Beyond this cape the sea constantly runs so high, that we can scarcely believe we are near a coast where (from the point of Paria as far as Cape San Roman) a gale of wind is never known. On the 20th of November at suarise we were so far advanced, that we might expect
to double the cape in a few hours. We hoped to reach La Guayra the same day; but our Indian pilot being afraid of the privateers who were near that port, thought it would be prudent to make for land, and anchor in the little harbour of Higuerote, which we had already passed, and await the shelter of night to proceed on our voyage.

On the 20th of November at nine in the morning we were at anchor in the bay just mentioned, situated westward of the mouth of the Rio Capaya. We foumd there neither village nor farm, but merely two or three huts, inhabited by Mestizo fishermen. Their livid hue, and the meagre condition of their children, sufficed to remind us that this spet is one of the most unhealthy of the whole coast. The sea has so little depth along these shores, that even with the smallest barks it is impossible to reach the shore without wading through the water. The forests come down nearly to the beach, which is covered with thickets of mangroves, avicennias, manchineel-trees, and that species of surians which the natives call romero de la mar.* To these thickets, and particularly to the exhalations of the mangroves, the extreme insalubrity of the air is attributed here, as in other places in both Indies. On quitting the boats, and whilst we were yet fifteen or twenty toises distant from land, we perceived a faint and sickly smell, which reminded me of that diffused through the galleries of deserted mines, where the lights begin to be extinguished, and the timber is covered with flocculent byssus. The temperature of the air rose to $34^{\circ}$, heated by the reverberation from the white sands which form a line between the mangroves and the great trees of the forest. As the shore descends with a gentle slope, small tides are sufficient alternately to cover and uncover the roots and part of the trunks of the mangroves. It is doubtless whilst the sun heats the humid wood, and causes the fermentation, as it were, of the ground, of the remains of cead leaves and of the molluscs enveloped in the dirift of floating seaweed, that those deleterious gases are formed, which escape our researches. We observed that the seawater, along the whole coast, acquired a yellowish brown tint, wherever it came into contact with the mangrove trees.

[^128]Struck with this phenomenon, I gathered at Higuerote a considerable quantity of branches and roots, for the purpose of making some experiments on the infusion of the mangrove, on my arrival at Caracas. The infusion in warm water had a brown colour and an astringent taste. It contained a mixture of extractive matter and tannin. The rhizophora, the misletoe, the cornel-tree, in short, all the plants which belong to the natural families of the lorantheous and the caprifoliaceous plants, have the same properties. The infusion of mangrove-wood, kept in contact with atmospheric air under a glass jar for twelve days, was not sensibly deteriorated in purity. A little blackish flocculent sediment was formed, but it was attended by no sensible absorption of oxygen. The wood and roots of the mangrove placed under water were exposed to the rays of the sun. I tried to imitate the daily operations of nature on the coasts at the rise of the tide. Bubbles of air were disengaged, and at the expiration of ten days they formed a volume of thirtythree cubic inches. They were a mixture of azotic gas and carbonic acid. Nitrous gas scarcely indicated the presence of oxygen.* Lastly, I set the wood and the roots of the mangrove thoroughly wetted, to act on a given volume of atmospheric air in a phial with a ground-glass stopple. The whole of the oxygen disappeared; and, far from being superseded by carbonic acid, lime-water indicated only 0.02 . There was even a dimunition of the volume of air, more than correspondent with the oxygen absorbed. These slight experiments led me to conclude that it is the moistened bark and wood which act upon the atmosphere in the forests of man-grove-trees, and not the water strongly tinged with yellow, forming a distinct band along the coasts. In pursuing the different stages of the decomposition of the ligneous matter, I observed no appearance of a disengagement of sulphuretted hydrogen, to which many travellers attribute the smell perceived amidst mangroves. The decomposition of the earthy and alkaline sulphates, and their transition to the state of sulphurets, may no doubt favour this disengagement in many littoral and marine plants; for instance, in the fuci : but I am rather inclined to think that the rhizophora, the avicen-

* In a hundred parts there were eighty-four of nitrogen, fifteen of carbonic acid gas that the water had not absorbed, and one of oxvgen.
nia, and the conocarpus, augment the insalubrity of the air by the animal matter which they contain conjointly with tannin. These shrubs belong to the three natural families of the Loranthex, the Combretaceæ, and the Pyrenacea, in which the astringent principle abounds; this principle accompanies gelatin, even in the bark of beech, alder, and nut-trees.

Moreover, a thick wood spreading over marshy grounds would diffuse noxious exhalations in the atmosphere, even though that wood were composed of trees possessing in themselves no deleterious properties. Wherever mangroves grow on the sea-shore, the beach is covered with infinite numbers of molluses and insects. These animals love shade and faint light, and they find themselves sheltered from the shock of the waves amid the scaffolding of thick and intertwining roots, which rises like lattice-work above the surface of the waters. Shell-fish cling to this lattice; crabs nestle in the hollow trunks; and the seaweeds, drifted to the coast by the winds and tides, remain suspended on the branches which incline towards the earth. Thus, maritime forests, by the accumulation of a slimy mud between the roots of the trees, increase the extent of land. But whilst these forests gain on the sea, they do not enlarge their own dimensions; on the contrary, their progress is the cause of their destruction. Mangroves, and other plants with which they live constantly in society, perish in proportion as the ground dries and they are no longer bathed with salt water. Their old trunks, covered with shells, and half-buried in the sand, denote, after the lapse of ages, the path they have followed in their migrations, and the limits of the land which they have wrested from the ocean.

The bay of Higuerote is favourably situated for examining Cape Codera, which is there seen in its full extent seven miles distant. This promontory is more remarkable for its size than for its elevation, being only about two hundred toises high. It is perpendicular on the north-west and east. In these grand profiles the dip of the strata appears to be distinguishable. Judging from the fragments of rock found along the coast, and from the hills near Higuerote, Cape Codera is not composed of granite with a granular texture, but of a real gneiss with a foliated texture. Its laminæ are
very broad and sometimes sinuous.* They contain darge nodules of reddish feldspar and but little quartz. The mica is found in superposed lamellse, not isolated. The strata nearest the bay were in the direction of $60^{\circ}$ N.E., and dipped $80^{\circ}$ to N.W. These relations of direction and of dip ane the same at the great mountain of the Silla, near Caraoss, and to the east of Maniquarez, in the isthmus of Araya. They seem to prove that the primitive chain of that isthmus, after having been ruptured or swallowed up by the sea along a space of thirty-five leagues, $\dagger$ appears anew in Cape Codera, and continues westward as a chain of the coast.

I was assured that, in the interior of the earth, south of Higuerote, limestone formations are found. The gneiss did not act upon the magnetic needle; yet along the coast, which forms a cove near Cape Codera, and which is covered with a fine forest, I saw magnetic sand mixed with spangles of mica, deposited by the sea. This phenomenon occurs again near the port of La Guayra. Possibly it may denote the existence of some strata of hornblende-schist covered by the waters, in which schist the sand is disseminated. Cape Codera forms on the north an immense spherical segment. A shallow which stretches along its foot is known to navigators by the name of the points of Tutumo and of San Francisco.
The road by land from Higuerote to Caracas, rins through a wild and humid tract of country, by the Montaña of Capaya, north of Caucagua, and the valley of Bio Guatira and Guarenas. Some of our fellow-travellers determined on taking this road, and M. Bonpland also preferred it, notwithstanding the continual rains and the overflowing of the rivers. It afforded him the opportunity of making a rich collection of new plants. $\ddagger$ For my part, I continued alone with the Guaiqueria pilot the voyage by :eea; for I throught it hazardous to lose sight of the instruments which we were to make use of on the banks of the Orinoco.

We set sail at night-fall. The wind was unfavourable, and we doubled Cape Codera with difficulty. The surges were

[^129]short, and eften broke one upon another. The sea ran the higher, owing to the wind being contrary to the current, till after midnight. The general motion of the waters within the tropics towards the west is felt strongly on the coast during two-thirds of the year. In the months of September, October, and November, the current often flows eastward for fifteen or twenty days in succession; and vessels on their way from Guayra to Porto Cabello have sometimes been unable to stem the current which runs from west to east, although they have had the wind astern. The canse of these anomalies is not yet discovered. The pilots think they are the effect of gales of wind from the north-west in the gulf of Mexico.

On the 21st of November, at sunrise, we were to the west of Cape Codera, opposite Curuao. The coast is rocky and very elevated, the scenery at once wild and picturesque. We were sufficiently near land to distinguish scattered huts surrounded by cocoa-trees, and masses of vegetation, which stood out from the dark ground of the rocks. The mountains are everywhere perpendicular, and three or four thousand feet high; their sides cast broad and deep shadows upon the humid land, which stretches out to the sea, glowing with the freshest verdure. This shore produces most of those fruits of the hot regions, which are seen in such great abondance in the markets of the Caracas. The fields cultivated with sugar-cane and maize, between Camburi and Niguatar, stretch through narrow valleys, looking like crevices or clefts in the rocks: and penetrated by the rays of the sun, then above the horizon, they presented the most singular contrasts of light and shade.

The mountain of Niguatar and the Silla of Caracas are the loftiest summits of this littoral chain. The first almost reaches the height of Canigou; it seems as if the Pyrenees or the Alps, stripped of their snows, had risen from the bosom of the ocean; so much more stupendous do mountains appear when viewed for the first time from the sea. Near Caravalleda, the cultivated lands enlarge; we find hills with gentle declivities, and the vegetation rises to a great height. The sugar-cane is here cultivated, and the monks of La Merced have a plantation with two hundred slaves. This spot was formerly extremely subject to fever; and it is
said that the air has acquired salubrity since trees have been planted round a small lake, the emanations of which were dreaded, and which is now less exposed to the ardour of the sun. To the west of Caravalleda, a wall of bare rock again projects forward in the direction of the sea, but it has little extent. After having passed it, we immediately discovered the pleasantly situated village of Macuto; the black rocks of La Guayra, studded with batteries rising in tiers one over another; and in the misty distance, Cabo Blanco, a long promontory with conical summits, and of dazzling whiteness. Cocoa-trees border the shore, and give it, under that burning sky, an appearance of fertility.

I landed in the port of La Guayra, and the same evening made preparations for transporting my instruments to Caracas. Having been recommended not to sleep in the town, where the yellow fever had been raging only a few weeks previously, I fixed my lodging in a house on a little hill, above the village of Maiquetia, a place more exposed to fresh winds than La Guayra. I reached Caracas on the 21st of November, four days sooner than M. Bonpland, who, with the other travellers on the land journey, had suffered greatly from the rain and the inundations of the torrents, between Capaya and Curiepe.

Before proceeding further, I will here subjoin a description of La Guayra, and the extraordinary road which leads from thence to the town of Caracas, adding thereto all the observations made by M. Bonpland and myself, in an excursion to Cabo Blanco about the end of January 1800.

La Guayra is rather a roadstead than a port. The sea is constantly agitated, and ships suffer at once by the violence of the wind, the tideways, and the bad anchorage. The lading is taken in with difficulty, and the swell prevents the embarkation of mules here, as at New Barcelona and Porto Cabello. The free mulattoes and negroes, who carry the cacao on board the ships, are a class of men remarkable for muscular strength. They wade up to their waists through the water; and it is remarkable that they are never attacked by the sharks, so common in this harbour. This fact seems connected with what I have often observed within the tropics, with respect to other classes of animals which live in society, for instance monkeys and crocodiles. In the Mis-
sions of the Orinoco, and on the banks of the river Amazon, the Indians, who catch monkeys to sell them, know very well that they can easily succeed in taming those which inhabit certain islands; while monkeys of the same species, caught on the neighbouring continent, die of terror or rage when they find themselves in the power of man. The crocodiles of one lake in the llanos are cowardly, and flee even when in the water; whilst those of another lake will attack with extreme intrepidity. It would be difficult to explain this difference of disposition and habits, by the mere aspect of the respective localities. The sharks of the port of La Guayra seem to furnish an analogous example. They are dangerous and blood-thirsty at the island opposite the coast of Caracas, at the Roques, at Bonayre, and at Curassao; while they forbear to attack persons swimming in the ports of La Guayra and Santa Martha. The natives, who like the ignorant mass of people in every country, in seeking the explanation of natural phenomena, always have recourse to the marvellous, affirm that in the ports just mentioned, a bishop gave his benediction to the sharks.

The situation of La Guayra is very singular, and can only be compared to that of Santa Cruz in Teneriffe. The chain of mountains which separates the port from the high valley of Caracas, descends almost directly into the sea; and the houses of the town are backed by a wall of steep rocks. There scarcely remains one hundred or one hundred and forty toises breadth of flat ground between the wall and the ocean. The town has six or eight thousand inhabitants, and contains only two streets, running parallel with each other east and west. It is commanded by the battery of Cerro Colorado; and its fortifications along the sea-shore are well disposed, and kept in repair. The aspect of this place has in it something solitary and gloomy; we seemed not to be on a continent, covered with vast forests, but on a rocky island, destitute of vegetation. With the exception of Cabo Blanco and the cocoa-trees of Maiquetia, no view meets the eye but that of the horizon, the sea, and the azure vault of heaven. The heat is excessive during the day, and most frequently during the night. The climate of La Guayra is justly considered to be hotter than that of Cumana, Porto Cabello, and Coro, because the sea-breeze is less felt, and the air is
heated by the radiant caloric which the perpendicular racks emit from the time the sun sets. The examinstion of the thermometric observations made during nime months at Ie Guayra by an eminent physician, enabled me to compare the climate of this port, with those of Cumana, of the Havannah, and of Vera Cruz. This comparison is the more interesting, as it furnishes an inexhaustible subject of conversation in the Spanish colonies, and among the mariners who frequent those latitudes. As nothing is more deceiving in such matters than the testimony of the senses, we can judge of the difference of climates only by numerical calculations.

The four places of which we have been speaking are considered as the hottest on the shores of the New World. A comparison of them may serve to confirm what we have several times observed, that it is generally the duration of a high temperature, and not the excess of heat, or its absolute quantity, which occasions the sufferings of the inhabitants of the torrid zone.

A series of thermometric observations shows, that La Guayra is one of the hottest places on the earth; that the quantity of heat which it receives in the course of a year is a little greater than that felt at Cumana; but that in the months of November, December, and January (at equal distance from the two passages of the sun through the eenith of the town), the atmosphere cools more at La Guayra. May not this cooling, much slighter than that which is felt almost at the same time at Vera Crux and at the Havannah, be the effect of the more westerly position of La Guayra? The aërial ocean, which appears to form only one mass, is agitated by currents, the limits of which are fixed by immutable laws; and its temperature is variously modified by the configuration of the lands and seas by which it is sustained. It may be subdivided into several basins, which overflow into each other, and of which the most agitated (for instance, that over the gulf of Mexico, or between the sierra of Santa Martha and the gulf of Darien) have a powerful influence on the refrigeration and the motion of the neighbouring columns of air. The north winds sometimes cause influxes and counter-currents in the south-west part of the Caribbean Sea, which seem, during particular months, to diminish the heat as far as Terra Firma.

At the time of my abode at La Guayra, the yellow fever, or calentura amarilla, had been known only two years; amd the mortality it occasioned had not been very great, beoause the confluence of strangers on the coast of Caracas was less considerable than at the Havannah or Vera Cruz. A few individuals, even creoles and mulattoes, were sometimes carried off suddenly by certain irregular remittent fevers; which, from being complicated with bilious appearances, hmmorrhages, and other symptoms equally alarming, appeared to have some analogy with the yellow fever. The victims of these maladies were generally men employed in the hard labour of cutting wood in the forests, for instance, in the neighbourhood of the little port of Carupano, or the gulf of Santa Fé, west of Cumana. Their death often adarmed the unacclimated Europeans, in towns usually regarded as peculiarly healthy; but the seeds of the sporadic malady were propagated no farther. On the coast of Terra Firma, the real typhus of America, which is known by the names vomito prieto (black vomit) and yellow fever, and which must be considered as a morbid affection sui generis, was known only at Porto Cabello, at Carthagena, and at Santa Martha, where Gastelbondo observed and described it in 1729. The Spaniards recently disembarked, and the inhabitants of the valley of Caracas, were not then afraid to reside at La Guayra. They complained only of the oppressive heat which prevailed during a great part of the year. If they exposed themselves to the immediate action of the sun, they dreaded at most only those attacks of inflammation of the skin or eyes, which are felt everywhere in the torrid zone, and are often accompanied by a febrile affection and congestion in the head. Many individuals preferred the ardent but uniform climate of La Guayra to the cool but extremely variable climate of Caracas; and scarcely any mention was made of the insalubrity of the former port.

Since the year 1797 everything has changed. Commerce being thrown open to other vessels besides those of the mother country, seamen born in colder parts of Europe than Spain, and consequently more susceptible to the climate of the torrid zone, began to frequent La Guayra. The yellow fever broke out. North Americans, seised with the typhus, were received in the Spanish hospitals; and it was
affirmed that they had imported the contagion, and that the disease had appeared on board a brig from Philadelphia, even before the vessel had entered the roads of La Guayra. The captain of the brig denied the fact; and asserted that, far from having introduced the malady, his crew had caught it in the port. We know from what happened at Cadiz in 1800, how difficult it is to elucidate facts, when their uncertainty serves to favour theories diametrically opposite one to another. The more enlightened inhabitants of Caracas and La Guayra, divided in opinion, like the physicians of Europe and the United States, on the question of the contagion of yellow fever, cited the instance of the American vessel; some for the purpose of proving that the typhus had come from abroad, and others, to show that it had taken birth in the country itself. Those who advocated the latter opinion, admitted that an extraordinary alteration had been caused in the constitution of the atmosphere by the overflowings of the Rio de La Guayra. This torrent, which in general is not ten inches deep, was swelled after sixty hours' rain in the mountains, in so extraordinary a manner, that it bore down trunks of trees and masses of rock of considerable size. During this flood the waters were from thirty to forty feet in breadth, and from eight to ten feet deep. It was supposed that, issuing from some subterranean basin, formed by successive infiltrations, they had flowed into the recently cleared arable lands. Many houses were carried away by the torrent; and the inundation became the more dangerous for the stores, in consequence of the gate of the town, which could alone afford an outlet to the waters, being accidentally closed. It was necessary to make a breach in the wall on the sea-side. More than thirty persons perished, and the damage was computed at half a million of piastres. The stagnant water, which infected the stores, the cellars, and the dungeons of the public prison, no doubt diffused miasms in the air, which, as a predisposing cause, may have accelerated the development of the yellow fever; but I believe that the inundation of the Rio de la Guayra was no more the primary cause, than the overflowings of the Guadalquivir, the Xenil, and the Gual-Medina, were at Seville, at Ecija, and at Malaga, the primary causes of the fatal epi-
demics of 1800 and 1804. I examined with attention the bed of the torrent of La Guayra; and found it to consist merely of a barren soil, blocks of mica-slate, and gneiss, containing pyrites detached from the Sierra de Avila, but nothing that could have had any effect in deteriorating the purity of the air.

Since the years 1797 and 1798, at which periods there prevailed dreadful mortality at Philadelphia, St. Lucia, and St. Domingo, the yellow fever has continued its ravages at La Guayra. It has proved fatal not only to the troops newly arrived from Spain, but also to those levied in parts remote from the coasts, in the llanos between Calabozo and Uritucu, regions almost as hot as La Guayra, but favourable to health. This latter fact would seem more surprising, did we not know, that even the natives of Vera Cruz, who are not attacked with typhus in their own town, sofhetimes sink under it during the epidemics of the Havannah and the United States. As the black vomit finds an insurmountable barrier at the Encero (four hundred and seventy-six toises high), on the declivity of the mountains of Mexico, in the direction of Xalapa, where oaks begin to appear, and the climate begins to be cool and pleasant, so the yellow fever scarcely ever passes beyond the ridge of mountains which separates La Guayra from the valley of Caracas. This valley has been exempt from the malady for a considerable time; for we must not confound the vomito and the yellow fever with the irregular and bilious fevers. The Cumbre and the Cerro de Avila form a very useful rampart to the town of Caracas, the elevation of which a little exceeds that of the Encero, but of which the mean temperature is above that of Xalapa.

I have published in another work* the observations made by M. Bonpland and myself on the locality of the towns periodically subject to the visitation of yellow fever; and I shall not hazard here any new conjectures on the changes observed in the pathogenic constitution of particular localities. The more I reflect on this subject, the more mysterious appears to me all that relates to those gaseous emanations which we call so vaguely the seeds of contagion, and which are supposed to be developed by a corrupted air, destroyed

* Nouvelle Espagne, tom. ii.
by cold, conveyed from place to place in garments, and asttached to the walls of houses. How can we explain why, for the space of eighteen years prior to 1794, there was not a single instance of the vomito at Vera Crun, though the concourse of unacclimated Europeans and of Mexicans from the interior, was very considerable; though sailors indulged in the same exceases with which they are still reproached; and though the town was not so clean as it has been since the year 1800?

The following is the series of pathological facts, considered in their simplest point of view. When a great number of persons, born in a cold climate, arrive at the same period in a port of the torrid zone, not particularly dreaded by navigators, the typhus of America begins to appear. Those persons have not had typhus during their passage; it appears among them only after they have landed. Is the atmospheric constitution changed? or is it that a new form of disease developes itself among individusls whose susceptibility is highly increased?

The typhus soon begins to extend its ravages among other Europeans, born in more southern countries. If propagated by contagion, it seems surprising that in the towns of the equinoctial continent it does not attach itself to certain streets; and that immediate contact* does not augment the danger, any more than seclusion diminishes it. The sick, when removed to the inland country, and especially to cooler and more elevated spots, to Xalapa, for instance, do not communicate typhus to the inhabitants of those places, either because the disease is not contagious in its nature, or because the predisposing causes are not the same as in the regions of the shore. When there is a considerable lowering of the temperature, the epidemic usually ceases, even on the spot where it first appeared. It again breaks out at the approach of the hot season, and sometimes long before; though

[^130]during several months there may have been no sick person in the harbour, and no ship may have entered it.

The typhus of America appears to be confined to the shore, either because persons who bring the disease disembark there, and goods supposed to be impregnated with deleterious miasms are there accumulated; or because on the sea-side gaseous emanations of a particular nature are formed. The aspect of the places subject to the ravages of typhus seems often to exclude all idea of a local or endemical origin. It has been known to prevail in the Cansries, the Bermudas, and among the small West India Islands, in dry places formerly distinguished for the great salubrity of their climate. Examples of the propagation of the yellow fever in the inland parts of the torrid zone appear very doubtful: that malady may have been confounded with remitting bilious fevers. With respect to the temperate zone, in which the contagious character of the American typhus is more decided, the disease has unquestionably spread far from the shore, even into very elevated places, exposed to cool and dry winds, as in Spain at Medina-Sidonia, at Carlotta, and in the city of Murcia. That variety of phenomena which the same epidemic exhibits, according to the difference of climate, the union of predisposing causes, its shorter or longer duration, and the degree of its exacerbation, should render ns extremely circumspect in tracing the secret causes of the American typhus. M. Bailly, who, at the time of the violent epidemics in 1802 and 1803, was chief physician to the colony of St. Domingo, and who studied that disease in the island of Cuba, the United States, and Spain, is of opinion that the typhus is very often, but not always, contagious.

Since the yellow fever has made such ravages in La Guayra, exaggerated accounts have been given of the uncleanliness in that little town as well as of Vera Cruz, and of the quays or wharfs of Philadelphia. In a place where the soil is extremely dry, destitute of vegetation, and where scarcely a few drops of water fall in the course of seven or eight months, the causes that produce what are called miasms, cannot be of very frequent occurrence. La Guayra appeared to me in general to be tolerably clean, with the exception of the quarter of the slaughter-houses. The sea-side has no beach on which the remains of fuci or molluses are heaped up; but the neigh-
bouring coast, which stretches eastward towards Cape Codera, and consequently to the windward of La Guayra, is extremely unhealthy. Intermitting, putrid, and bilious fevers often prevail at Macuto and at Caravalleda; and when from time to time the breeze is interrupted by a westerly wind, the little bay of Cotia sends air loaded with putrid emanstions towards the coast of La Guayra, notwithstanding the rampart opposed by Cabo Blanco.

The irritability of the organs being so different in the people of the north and those of the south, it cannot be doubted, that with greater freedom of commerce, and more frequent and intimate communication between countries situated in different climates, the yellow fever will extend its ravages in the New World. It is even probable that the concurrence of so many exciting causes, and their action on individuals so differently organized, may give birth to new forms of disease and new deviations of the vital powers. This is one of the evils that inevitably attend rising civilization.

The yellow fever and the black vomit cease periodically at the Havannah and Vera Cruz, when the north winds bring the cold air of Canada towards the gulf of Mexico. But from the extreme equality of temperature which characterizes the climates of Porto Cabello, La Guayra, New Barcelona, and Cumana, it may be feared that the typhus will there become permanent, whenever, from a great influx of strangers, it has acquired a high degree of exacerbation.

Tracing the granitic coast of La Guayra westward, we find between that port (which is in fact but an ill-sheltered roadstead) and that of Porto Cabello, several indentations of the land, furnishing excellent anchorage for ships. Such are the small bay of Catia, Los Arecifes, Puerto-laCruz, Choroni, Sienega de Ocumare, Turiamo, Burburata, and Patanebo. All these ports, with the exception of that of Burburata, from which mules are exported to Jamaica, are now frequented only by small coasting vessels, which are there laden with provisions and cacao from the surrounding plantations. The inhabitants of Caracas are desirous to avail themselves of the anchorage of Catia, to the west of Cabo Blanco. M. Bonpland and myself examined that point of the coast during our second abode
at La Guayra. A ravine, called the Quebrada de Tipe, descends from the table-land of Caracas towards Catia. A plan has long been in contemplation for making a cartroad through this ravine and abandoning the old road to La Guayra, which resembles the passage over St. Gothard. According to this plan, the port of Catia, equally large and secure, would supersede that of La Guayra. Unfortunately, however, all that shore, to leeward of Cabo Blanco, abounds with mangroves, and is extremely unhealthy. I ascended to the summit of the promontory, which forms Cabo Blanco, in order to observe the passage of the sun over the meridian. I wished to compare in the morning the altitudes taken with an artificial horizon and those taken with the horizon of the sea; to verify the apparent depression of the latter, by the barometrical measurement of the hill. By this method, hitherto very little employed, on reducing the heights of the sun to the same time, a reflecting instrument may be used like an instrument furnished with a level. I found the latitude of the cape to be $10^{\circ} 36^{\prime} 45^{\prime \prime}$; I could only make use of the angles which gave the image of the sun reflected on a plane glass; the horizon of the sea was very misty, and the windings of the coast prevented me from taking the height of the sun on that horizon.

The environs of Cabo Blanco are not uninteresting for the study of rocks. The gneiss here passes into the state of mica-slate,* and contains, along the sea-coast, layers of schistose chlorite. 7 In this latter I found garnets and magnetical sand. On the road to Catia we see the chloritic schist passing into hornblende schist. $\ddagger$ All these formations are found together in the primitive mountains of the old world, especially in the north of Europe. The sea at the foot of Cabo Blanco throws up on the beach rolled fragments of a rock, which is a granular mixture of hornblende and lamellar feldspar. It is what is rather vaguely called primitive grunstein. In it we can recognize traces of quartz and pyrites. Submarine rocks probably exist near the coast, which furnish these very hard masses. I have

[^131]$\ddagger$ Hornblendschiefer.
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compared them in my journal to the paterleation of Fichtelberg, in Franconia, which is also a diabase, but so fusible, that glass buttons are made of it, which are employed in the slave-trade on the coast of Guinea. I believed at first, according to the analogy of the phenomens furnished by the mountains of Franconia, that the presence of these hornblende masses with crystals of common (uncompact) feldspar indicated the proximity of transition rocks; but in the high valley of Caracas, near Antimano, balls of the same diabase fill a vein crossing the mica-slate. On the western declivity of the hill of Cabo Blanco, the gneiss is covered with a formation of sandstone, or conglomerate, extremely recent. This sandstone combines angular fragments of gneiss, quartz, and chlorite, magnetical sand, madrepores, and petrified bivalve shells. Is this formation of the same date as that of Punta Araya and Cumana?

Scarcely any part of the coast has so burning a climate as the environs of Cabo Blanco. We suffered mach from the heat, augmented by the reverberation of a barren and dusty soil; but without feeling any bad consequences from the effects of insolation. The powerful action of the sun on the cerebral functions is extremely dreaded at La Guayra, especially at the period when the yellow fever begins to be felt. Being one day on the terrace of the house, observing at noon the difference of the thermometer in the sun and in the shade, a man approached me holding in his hand a potion, which he conjured me to swallow. He was a physician, who from his window, had observed me bareheaded, and exposed to the rays of the sun. He assured me, that, being a native of a very northern climate, I should infallibly, after the imprudence I had committed, be attacked with the yellow fever that very evening, if I refused to take the remedy against it. I was not alarmed by this prediction, however serious, believing myself to have been long acclimated; but I could not resist yielding to entreaties, prompted by such benevolent feelings. I swallowed the dose; and the physician doubtless counted me among the number of those he had saved.

The road leading from the port to Caracas (the capital of a government of near 900,000 inhabitants) resembles, as I have already observed, the passage over the Alps,
the road of St. Gothard, and of the Great St. Bernard. Taking the level of the road had never been attempted before my arrival in the province of Venezuela. No precise idea had even been formed of the elevation of the valley of Caracas. It had indeed been long observed, that the descent was much less from La Cumbre and Las Vueltas (the latter is the culminating point of the road towards the Pastora at the entrance of the valley of Caracas), than towards the port of La Guayra; but the mountain of Avila having a very considerable bulk, the eye cannot discern simultaneously the points to be compared. It is even impossible to form a precise idea of the elevation of Caracas, from the climate of the valley, where the atmosphere is cooled by the descending currents of air, and by the mists, which envelope the lofty summit of the Silla during a great part of the year.

When in the season of the great heats we breathe the burning atmosphere of La Guayra, and turn our eyes towards the mountains, it seems scarcely possible that, at the distance of five or six thousand toises, a population of forty thousand individuals assembled in a narrow valley, enjoys the coolness of spring, a temperature which at night descends to $12^{\circ}$ of the centesimal thermometer. This near approach of different climates is common in the Cordillera of the Andes; but everywhere, at Mexico, at Quito, in Peru, and in New Granada, it is only after a long journey into the interior, either across plains or along rivers, that we reach the great cities, which are the central points of civilization. The height of Caracas is but a third of that of Mexico, Quito, and Santa Fé de Bogotá; yet of all the capitals of Spanish America which enjoy a cool and delicious climate in the midst of the torrid zone, Caracas is nearest to the coast. What a privilege for a city to possess a seaport at three leagues distance, and to be situated among mountains, on a table-land, which would produce wheat, if the cultivation of the coffee-tree were not preferred!

The road from La Guayra to the valley of Caracas is infinitely finer than the road from Honda to Santa Fé, or that from Guayaquil to Quito. It is kept in better order than the old road, which led from the port of Vera Cruz to Perote, on the eastern declivity of the mountains of New

Spain. 'With good mules it takes but three hours to go from the port of La Guayra to Caracas; and only two hours to return. With loaded mules, or on foot, the journey is from four to five hours. The road runs along a ridge of rocks extremely steep, and after passing the stations bearing respectively the names of Torre Quemada, Curucuti, and Salto, we arrive at a large inn (La Venta) built at six hundred toises above the level of the sea. The name Torre Quemada, or Burnt Tower, indicates the sensation that is felt in descending towards La Guayra. A suffocating heat is reflected from the walls of rock, and especially from the barren plains on which the traveller looks down. On this road, as on that from Vera Cruz to Mexico, and wherever on a rapid declivity the climate changes, the increase of muscular strength and the sensation of well-being, which we experience as we advance into strata of cooler air, have always appeared to me less striking than the feeling of languor and debility which pervades the frame, when we descend towards the burning plains of the coast. But such is the organization of man; and even in the moral world, we are less soothed by that which ameliorates our condition than annoyed by a new sensation of discomfort.

From Curucuti to Salto the ascent is somewhat less laborious. The sinuosities of the way render the declivity easier, as in the old road over Mont Cenis. The Salto (or Leap) is a crevice, which is crossed by a draw-bridge. Fortifications crown the summit of the mountain. At La Venta the thermometer at noon stood at $19 \cdot 3^{\circ}$, when at La Guayra it kept up at the same hour at $26 \cdot 2^{\circ}$. La Venta enjoys some celebrity in Europe and in the United States, for the beauty of its surrounding scenery. When the clouds permit, this spot affords a magnificent view of the sea, and the neighbouring coasts. An horizon of more than twenty-two leagues radius is visible; the white and barren shore reflects a dazzling mass of light; and the spectator beholds at his feet Cabo Blanco, the village of Maiquetia with its cocoatrees, La Guayra, and the vessels in the port. But I found this view far more extraordinary, when the sky was not serene, and when trains of clouds, strongly illumined on their upper surface, seemed projected like floating islands on the ocean. Strata of vapour, hovering at different
heights, formed intermediary spaces between the eye and the lower regions. By an illusion easily explained, they enlarged the scene, and rendered it more majestic. Trees and dwellings appeared at intervals through the openings, which were left by the clouds when driven on by the winds, and rolling over one another. Objects then appear at a greater depth than when seen through a pure and uniformly serene air. On the declivity of the mountains of Mexico, at the same height (between Las Trancas and Xalapa), the sea is twelve leagues distant, and the view of the coast is confused; while on the road from La Guayra to Caracas we command the plains (the tierra caliente), as from the top of a tower. How extraordinary must be the impression created by this prospect on natives of the inland parts of the country, who behold the sea and ships for the first time from this point.

I determined by direct observations the latitude of La Venta, that I might be enabled to give a more precise idea of the distance of the coasts. The latitude is $10^{\circ} 33^{\prime} 9^{\prime \prime}$. Its longitude appeared to me by the chronometer, nearly $2^{\prime} 47^{\prime \prime}$ west of the town of Caracas. I found the dip of the needle at this height to be $41.75^{\circ}$, and the intensity of the magnetic forces equal to two hundred and thirty-four oscillations. From the Venta, called also La Venta Grande, to distinguish it from three or four small inns formerly established along the road, but now destroyed, there is still an ascent of one hundred and fifty toises to Guayavo. This is nearly, the most lofty point of the road.

Whether we gaze on the distant horizon of the sea, or turn our eyes south-eastward, in the direction of the serrated ridge of rocks, which seems to unite the Cumbre and the Silla, though separated from them by the ravine (quebrada) of Tocume, everywhere we admire the grand character of the landscape. From Guayavo we proceed for half an hour over a smooth table-land, covered with alpine plants. This part of the way, on account of its windings, is called Las Vuettas. We find a little higher up the barracks or magazines of flour, which were constructed in a spot of cool temperature by the Guipuzcoa Company, when they had the exclusive monopoly of the trade of Caracas, and supplied that place with provision. On the road to Las Vueltas we see for the first time
the eapital, situated three hundred toises below, in a valley luxuriantly planted with coffee and European fruit-trees. Travellers are accustomed to halt near a fine spring, known by the name of Fuente de Sanchorquiz, which flows down from the Sierra on sloping strata of gneiss. I found its temperature $16.4^{\circ}$; which, for an elevation of seven hundred and twenty-six toises, is considerably cool, and it would appear much cooler to those who drink its limped water, if, instead of gushing out between La Cumbre and the temperate valley of Caracas, it were found on the descent towards La Guayra. But at this descent on the northern side of the mountain, the rock, by an uncommon exception in this country, does not dip to north-west, but to south-east, which prevents the subterranean waters from forming springs there.

We continued to descend from the small ravine of Sanehorquiz to la Cruz de la Guayra, a cross erected on an open spot, six hundred and thirty-two toises high, and thence (entering by the custom-house and the quarter of the Pastora) to the city of Caracas. On the south side of the mountain of Avila, the gneiss presents several geognostical phenomena worthy of the attention of travellers. It is traversed by veins of quartz, containing cannulated and often articulated prisms of rutile titanite two or three lines in diameter. In the fissures of the quartz we find, on breaking it, very thin crystals, which crossing each other form a kind of network. Sometimes the red schorl occurs only in dendritic crystals of a bright red.* The gneiss of the valley of Caracas is characterized by the red and green garnets it contains; they however disappear when the rock passes into mica-slate. This same phenomenon has been-remarked by Von Buch in Sweden; but in the temperate parts of Europe garnets are in general contained in serpentine and micasiartes, not in gneiss. In the walls which enclose the gardens of Caracas, constructed partly of fragments of gneiss, we find garnets of a very fine red, a little transparent, and very difficult to detach. The gneiss near the Cross of La Guayra, half a league from Caracas, presented also vestiges of

[^132]azure copper-ore* disseminated in veins of quartz, and small strata of plumbago (black lead), or earthy carburetted iron. This last is found in pretty large masses, and sometimes mingled with sparry iron-ore, in the ravine of Tocume, to the west of the Silla.

Between the spring of Sanchorquiz and the Cross of La Guayra, as well as still higher up, the gneiss contains considerable beds of saccharoidal bluish-grey primitive limestone, coarse-grained, containing mica, and traversed by veins of white calcareous spar. The mica, with large folia, lies in the direction of the dip of the strata. I found in the primitive limestone a great many crystallized pyrites, and rhomboidal fragments of sparry iron-ore of Isabella yellow. I endeavoured, but without success, to find tremolite, $\dagger$ which in the Fitehelberg, in Franconia, is common in the prinitive limestone without dolomite. In Europe beds of primitive limestone are generally observed in the mica-slates; but we find also saccharoidal limestone in gneiss of the most ancient formation, in Sweden near Upsala, in Saxony near Burkersdorf, and in the Alps in the road over the Simplon. These situations are analogous to that of Caracas. The phenomena of geognosy, particularly those which are connected with the stratification of rocks, and their grouping, are never solitary; but are found the same in both hemispheres. I was the more struck with these relations, and this identity of formations, as, at the time of my journey in these countries, mineralogists were unacquainted with the name of a single rock of Vepezuela, New Grenada, and the Cordilleras of Quito.

* Blue carbonate of copper.
$\dagger$ Grammatite of Haüy. The primitive limestone above the spring of Sanchorquiz, is directed, as the gneiss in that place, hor. $5 \cdot 2$, and dips $45^{\circ}$ north; but the general direction of the gneiss is, in the Cerro de Avila, hor. 3.4 with $60^{\circ}$ of dip N.W. Exceptions merely local are observed in a small space of ground near the Cross of La Guayra (hor. $6 \cdot 2, \operatorname{dip} 8^{\circ} \mathrm{N}$.) ; and higher up, opposite the Quebrada of Tipe (hor. 12, $\operatorname{dip} 50^{\circ}$ W.).


## Chapter XII.

General View of the Provinces of Venezuela.-Diversity of their Interests, -City and Valley of Caracas.-Climate.

In all those parts of Spanish America in which civilization did not exist to a certain degree before the Conquest (as it did in Mexico, Guatimala, Quito, and Peru), it has advanced from the coasts to the interior of the country, following sometimes the valley of a great river, sometimes a chain of mountains, affording a temperate climate. Concentrated at once in different points, it has spread as if by diverging rays. The union into provinces and kingdoms was effected on the first immediate contact between civilized parts, or at least those subject to permanent and regular government. Lands deserted, or inhabited by savage tribes, now surround the countries which European civilization has subdued. They divide its conquests like arms of the sea difficult to be passed, and neighbouring states are often connected with each other only by slips of cultivated land. It is less difficult to acquire a knowledge of the configuration of coasts washed by the ocean, than of the sinuosities of that interior shore, on which barbarism and civilization, impenetrable forests and cultivated land, touch and bound each other. From not having reflected on the early state of society in the New World, geographers have often made their maps incorrect, by marking the different parts of the Spanish and Portuguese colonies, as though they were contiguous at every point in the interior. The local knowledge which I obtained respecting these boundaries, enables me to fix the extent of the great territorial divisions with some certainty, to compare the wild and inhabited parts, and to appreciate the degree of political influence exercised by certain towns of America, as centres of power and of commerce.

Caracas is the capital of a country nearly twice as large as Peru, and now little inferior in extent to the kingdom of New Grenada.* This country which the Spanish govern-
*The Capitania-General of Caracas contains near 48,000 square leagues (twenty-five to a degree). Peru, since La Paz, Potosi, Charcas,
ment designates by the name of Capitania-General de Caracas,* or of the united provinces of Venezuela, has nearly a million of inhabitants, among whom are sixty thousand slaves. It comprises, along the coasts, New Andalusia, or the province of Cumana (with the island of Margareta), $\dagger$ Barcelona, Venezuela or Caracas, Coro, and Maracaybo; in the interior, the provinces of Varinas and Guiana; the former situated on the rivers of Santo Domingo and the Apure, the latter stretching along the Orinoco, the Casiquiare, the Atabapo, and the Rio Negro. In a general view of the seven united provinces of Terra Firma, we perceive that they form three distinct zones, extending from east to west.

We find, first, cultivated land along the sea-shore, and near the chain of the mountains on the coast; next, savannahs or pasturages; and finally, beyond the Orinoco, a third zone, that of the forests, into which we can penetrate only by the rivers which traverse them. If the native inhabitants of the forests lived entirely on the produce of the chase, like those of the Missouri, we might say that the three zones into which we have divided the territory of Venezuela, picture the three states of human society; the life of the wild hunter, in the woods of the Orinoco; pastoral life, in the savannahs or llanos; and the agricultural state, in the high valleys, and at the foot of the mountains on the coast. Missionary monks and some few soldiers occupy here, as throughout all Spanish America, advanced posts along the frontiers of Brazil. In this first zone are felt the preponderance of force, and the abuse of power, which is its necessary consequence. The natives carry on civil war, and sometimes devour one another. The monks endeavour to augment the number of little villages of their Missions, by taking advantage of the dissensions of the natives. The mili-
and Santa Cruz de la Sierra, have been separated from it, contains only30,000. New Grenada, including the province of Quito, contains 65,000. Reinos, Capitanias-Generales, Presidencias, Goviernos, and Provincias, are the names by which Spain formerly distinguished her transmarine possessions, or, as they were called, 'Dominios de Ultramar' (Dominions beyond Sea.)

* The captain-general of Caracas has the title of "Capitan-General de las Provincias de Venezuela y Ciudad de Caracas."
$\dagger$ This island, near the coast of Cumana, forms a separate goviernos depending immediately on the captain-general of Caracas.
tary live in a state of hostility to the monks, whom they were intended to protect. Everything presents a melancholy picture of misery and privation. We shall soon have oecasion to examine more closely that state of man, which is vaunted as a state of nature, by those who inhabit towns. In the second region, in the plains and pasture-grounds, food is extremely abundant, but has little variety. Although more advanced in civilization, the people beyond the circle of some scattered towns are not less isolated from one another. At sight of their dwellings, partly covered with skins and leather, it might be supposed that, far from being fixed, they are scarcely encamped in those vast plains which extend to the horizon. Agriculture, which alone consolidates the bases, and strengthens the bonds of society, occupies the third zone, the shore, and especially the hot and temperate valleys among the mountains near the sea.

It may be objected, that in other parts of Spanish and Portuguese America, wherever we can trace the progressive development of civilization, we find the three ages of society combined. But it must be remembered that the position of the three zones, that of the forests, the pastures, and the cultivated land, is not everywhere the same, and that it is nowhere so regular as in Venezuela. It is not always from the coast to the interior, that population, commercial industry, and intellectual improvement, diminish. In Mexico, Peru, and Quito, the table-lands and central mountains possess the greatest number of cultivators, the most numerous towns situated near to each other, and the most ancient institutions. We even find, that, in the kingdom of Buenos Ayres, the region of pasturage, known by the name of the Pampas, lies between the isolated part of Buenos Ayres and the great mass of Indian cultivators, who inhabit the Cordilleras of Charcas, La Paz, and Potosi. This circum--stance gives birth to a diversity of interests, in the same country, between the people of the interior and those who inhabit the coasts.

To form an accurate idea of those vast provinces which have been governed for ages, almost like separate states, by viceroys and captains-general, we must fix our attention at once on several points. We must distinguish the parts of Spanish America opposite to Asia from those on the shores
of the Atlantic; we must ascertain where the greater portion of the population is placed; whether near the coast, or concentrated in the interior, on the cold and temperate table-lands of the Cordilleras. We must verify the numerical proportions between the natives and other castes; search into the origin of the European families, and examine to what race, in each part of the colonies, belongs the greater number of whites. The Andalusian-Canarians of Venezuela, the Mountaineers* and the Biscayans of Mexico, the Catalonians of Buenos Ayres, differ essentially in their aptitude for agriculture, for the mechanical arts, for commerce, and for all objects connected with intellectual development. Each of those races has preserved, in the New as in the Old World, the shades that constitute its national physiognomy; its asperity or mildness of character; its freedom from sordid feelings, or its excessive love of gain; its social hospitality, or its taste for solitude. In the countries where the population is for the most part composed of Indians and mixed races, the difference between the Europeans and their descendants cannot indeed be so strongly marked, as that which existed anciently in the colonies of Ionian and Doric origin. The Spaniards transplanted to the torrid zone, estranged from the habits of their mother-country, must have felt more sensible changes than the Greeks settled on the coasts of Asia Minor, and of Italy, where the climates differ so little from those of Athens and Corinth. It cannot be denied that the character of the Spanish Americans has been variously modified by the physical nature of the country; the isolated sites of the capitals on the table-lands or in the vicinity of the coasts; the agricultural life; the labour of the mines, and the habit of commercial speculation: but in the inhabitants of Caracas, Santa Fé, Quito, and Buenos Ayres, we recognize everywhere something which belongs to the race and the filiation of the people.

If we examine the state of the Capitania-General of Caracas, according to the principles here laid down, we perceive that agricultural industry, the great mass of popuIation, the numerous towns, and everything connected with advanced civilization, are found near the coast. This coast

* Montañeses. The inhabitants of the mountains of Santander are called by this name in Spain.
extends along a space of two hundred leagues. It is washed by the Caribbean Sea, a sort of Mediterranean, on the shores of which almost all the nations of Europe have founded colonies; which communicates at several points with the Atlantic; and which has had a considerable influence on the progress of knowledge in the eastern part of equinoctial America, from the time of the Conquest. The kingdoms of New Grenada and Mexico have no connection with foreign colonies, and through them with the nations of Europe, except by the ports of Carthagena, of Santa Martha, of Vera Cruz, and of Campeachy. These vast countries, from the nature of their coasts, and the isolation of their inhabitants on the back of the Cordilleras, have few points of contact with foreign lands. The gulf of Mexico also is but little frequented during a part of the year, on account of the danger of gales of wind from the north. The coasts of Venezuela, on the contrary, from their extent, their eastward direction, the number of their ports, and the safety of their anchorage at different seasons, possess all the advantages of the Caribbean Sea. The communications with the larger islands, and even with those situated to windward, can nowhere be more frequent than from the ports of Cumana, Barcelona, La Guayra, PortoCabello, Coro, and Maracaybo. Can we wonder that this facility of commercial intercourse with the inhabitants of free America, and the agitated nations of Europe, should in the provinces united under the Capitania-General of Venezuela, have augmented opulence, knowledge, and that restless desire of a local government, which is blended with the love of liberty and republican forms?

The copper-coloured natives, or Indians, constitute an important mass of the agricultural population only in those places where the Spaniards, at the time of the Conquest, found regular governments, social communities, and ancient and very complicated institutions; as, for example, in New Spain, south of Durango; and in Peru, from Cuzco to Potosi. In the Capitania-General of Caracas, the Indian population is inconsiderable, at least beyond the Missions and in the cultivated zone. Even in times of great political excitement, the natives do not inspire any apprehension in the whites or the mixed castes. Computing, in 1800, the
total population of the seven united provinces at nine hundred thousand souls, it appeared to me that the Indians made only one-ninth; while at Mexico they form nearly one half of the inhabitants.

Considering the Caribbean Sea, of which the gulf of Mexico makes a part, as an interior sea with several mouths, it is important to fix our attention on the political relations arising out of this singular configuration of the New Continent, between countries placed around the same basin. Notwithstanding the isolated state in which most of the mother-countries endeavour to hold their colonies, the agitations that take place are not the less communicated from one to the other. The elements of discord are everywhere the same; and, as if by instinct, an understanding is established between men of the same colour, although separated by difference of language, and inhabiting opposite coasts. That American Mediterranean formed by the shores of Venezuela, New Grenada, Mexico, the United States, and the West India Islands, counts upon its borders near a million and a half of free and enslaved blacks; but so unequally distributed, that there are very few to the south, and scarcely any in the regions of the west. Their great accumulation is on the northern and eastern coasts, which may be said to be the African part of the interior basin. The commotions which since 1792 have broken out in St. Domingo, have naturally been propagated to the coasts of Venezuela. So long as Spain possessed those fine colonies in tranquillity, the little insurrections of the slaves were easily repressed; but when a struggle of another kind, that for independence, began, the blacks by their menacing position excited alternately the apprehensions of the opposite parties; and the gradual or instantaneous abolition of slavery has been proclaimed in different regions of Spanish America, less from motives of justice and humanity, than to secure the aid of an intrepid race of men, habituated to privation, and fighting for their own cause. I found in the narrative of the voyage of Girolamo Benzoni, a curious passage, which proves that the apprehensions caused by the increase of the black population are of very old date. These apprehensions will cease only where governments shall second by laws the progressive reforms which refinement of manners, opinion,
and religious sentiment, introduce into domestic slavery. "The negroes," says Benzoni, "multiply so much at St. Domingo, that in 1545, when I was in Terra Firma [on the coast of Caracas], I saw many Spaniards who had no doubt that the island would shortly be the property of the blacks." It was reserved for our age to see this prediction accomplished; and a European colony of America transform itself into an African state.

The sixty thousand slaves which the seven united provinces of Venezuela are computed to contain, are so unequally divided, that in the province of Caracas alone there are nearly forty thousand, one-fifth of whom are mulattoes; in Maracaybo, there are ten or twelve thousand; but in Cumana and Barcelona, scarcely six thousand. To judge of the influence which the slaves and men of colour exercise on the public tranquility, it is not enough to know their number, we must consider their accunulation at certain points, and their manner of life, as cultivators or inhabitants of towns. In the province of Venezuela, the slaves are assembled together on a space of no great extent, between the coast, and a line which passes (at twelve leagues from the coast) through Panaquire, Yare, Sabana de Ocumare, Villa de Cura, and Nirgua. The llanos or vast plains of Calaboso, San Carlos, Guanare, and Barquecimeto, contain only four or five thousand slaves, who are scattered among the farms, and employed in the care of cattle. The number of free men is very considerable; the Spanish laws and customs being favourable to affranchisement. A master cannot refuse liberty to a slave who offers him the sum of three hundred piastres, even though the slave may have cost double that price, on account of his industry, or a particular aptitude for the trade he practises. Instances of persons who voluntarily bestow liberty on a certain number of their slaves, are more common in the

[^133]province of Venezuela than in any other place. A short time before we visited the fertile valleys of Aragua and the lake of Valencia, a lady who inhabited the great village of Victoria, ordered her children, on her death-bed, to give liberty to all her slaves, thirty in number. I feel pleasure in recording facts that do honour to the character of a people from whom M. Bonpland and myself received so many marks of kindness.

If we compare the seven united provinces of Venezuela with the kingdom of Mexico and the island of Cuba, we shall succeed in finding the approximate number of white Creoles, and even of Europeans. The white Creoles, whom I may call Hispano-Americans,* form in Mexico nearly a fifth, and in the island of Cuba, according to the very accurate enumeration of 1801, a third of the whole population. When we reflect that the kingdom of Mexico contains two millions and a half of natives of the copper-coloured race; when we consider the state of the coasts bordering on the Pacific, and the small number of whites in the intendencias of Puebla and Oaxaca, compared with the natives, we cannot doubt that the province of Venezuela at least, if not the capitania-general, has a greater proportion than that of one to five. The island of Cuba, t in which the whites are even more numerous than in Chile, may furnish us with a limiting number, that is to say, the maximum which may be supposed in the capitania-general of Caracas. I believe we must stop at at two hundred, or two hundred and ten thousand Hispano-Americans, in a total population of nine hundred thousand souls. The number of Europeans included in the white race (not comprehending the troops sent from the mother-country) does not exceed twelve or fifteen thousand. It certainly is not greater at Mexico than sixty thousand; and I find by several statements, that, if we estimate the whole of the Spanish colonies at fourteen or

- In imitation of the word Anglo-American, adapted in all the languages of Europe. In the Spanish colonies, the whites born in America are called Spaniards; and the real Spaniards, those born in the mothercountry, are called Europeans, Gachupins, or Chapetons.
+ I do not mention the kingdom of Buenos Ayres, where, among a million of inhabitants, the whites are extremely numerous in parts near the coast; while the table-lands, or provinces of the sierra, are almost entirely peopled with natives.
fifteen millions of inhabitants, there are in that number at most three millions of Creole whites, and two hundred thousand Europeans.

When Tupac-Amaru, who believed himself to be the legitimate heir to the empire of the Incas, made the conquest of several provinces of Upper Peru, in 1781, at the head of forty thousand Indian mountaineers, all the whites were filled with alarm. The Hispano-Americans felt, like the Spaniards born in Europe, that the contest was between the copper-coloured race and the whites; between barbarism and civilization. Tupac-Amaru, who himself was not destitute of intellectual cultivation, began with flattering the creoles and the European clergy; but soon, impelled by events, and by the spirit of vengeance that inspired his nephew, Andres Condorcanqui, he changed his plan. A rising for independence became a cruel war between the different castes; the whites were victorious, and excited by a feeling of common interest, from that period they kept watchful attention on the proportions existing in the different provinces between their numbers and those of the Indians. It was reserved for our times to see the whites direct this attention towards themselves; and examine, from motives of distrust, the elements of which their own caste is composed. Every enterprise in favour of independence and liberty puts the national or American party in opposition to the men of the mother-country. When I arrived at Caracas, the latter had just escaped from the danger with which ther thought they were menaced by the insurrection projected by España. The consequences of that bold attempt were the more deplorable, because, instead of investigating the real causes of the popular discontent, it was thought that the mother-country would be saved by employing vigorous measures. At present, the commotions which have arisen throughout the country, from the banks of the Rio de ls Plata to New Mexico, an extent of fourteen hundred leagues, have divided men of a common origin.

The Indian population in the united provinces of Venezuela is not considerable, and is but recently civilized. All the towns were founded by the Spanish conquerors, who could not carry out, as in Mexico and Peru, the old civilization of the natives. Caracas, Maracaybo, Cumana, and

Coro, have nothing Indian but their names. Compared with the three capitals of equinoctial America,* situated on the mountains, and enjoying a temperate climate, Caracas is the least elevated. It is not a central point of commerce, like Mexico, Santa Fé de Bogotá, and Quito. Each of the seven provinces united in one capitania-general has a port, by which its produce is exported. It is sufficient to consider the position of the provinces, their respective degree of intercourse with the Windward Islands, the direction of the mountains, and the course of the great rivers, to perceive that Caracas can never exercise any powerful political influence over the territories of which it is the capital. The Apure, the Meta, and the Orinoco, running from west to east, receive all the streams of the llanos, or the region of pasturage. St. Thomas de la Guiana will necessarily, at some future day, be a trading-place of high importance, especially when the flour of New Grenada, embarked above the confluence of the Rio Negro and the Umadea, and descending by the Meta and Orinoco, shall be preferred at Caracas and Guiana to the flour of New England. It is a great advantage to the provinces of Venezuela, that their territorial wealth is not directed to one point, like that of Mexico and New Grenada, which flows to Vera Cruz and Carthagena; but that they possess a great number of towns equally well peopled, and forming various centres of commerce and civilization.

The city of Caracas is seated at the entrance of the plain of Chacao, which extends three leagues eastward, in the direction of Caurimare and the Cuesta de Auyamas, and is two leagues and a half in breadth. This plain, through which runs the Rio Guayra, is at the elevation of four hundred and fourteen toises above the level of the sea. . The ground on which the city of Caracas is built is uneven, and has a steep slope from N.N.W. to S.S.E. To form an accurate idea of the situation of Caracas, we must bear in mind the general direction of the mountains of the coast, and the great longitudinal valleys by which they are traversed. The

* Mexico, Santa Fé de Bogoté, and Quito. The elevation of the site of the capital of Guatimala is still unknown. Judging from the vegetation, we may infer that it is less than 500 toises.

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Rio Guayra rises in the group of primitive mountains of Higuerote, which separates the valley of Caracas from that of Aragua. It is formed near Las Ajuntas, by the junction of the little rivers of San Pedro and Macarao, and runs first eastward as far as the Cuesta of Auyamas, and then southward, uniting its waters with those of the Rio Tuy, below Yare. The Rio Tuy is the only considerable river in the northern and mountainous part of the province.

The river flows in a direct course from west to east, the distance of thirty leagues, and it is navigable along more than three quarters of that distance. By barometrical mea: surements I found the slope of the Tuy along this length, from the plantation of Manterols* to its mouth, east of Cape Codera, to be two hundred and ninety-five toises. This river forms in the chain of the coast a kind of longitudinal valley, while the waters of the llanos, or of fivesixths of the province of Caracas, follow the slope of the land sonthward, and join the Orinoco. This hydrographic sketch may throw some light on the natural tendency of the inhabitants of each particular province, to export their productions by different roads.

The valleys of Caracas and of the Tuy run parallel for a considerable length. They are separated by a mountainous tract, which is crossed in going from Caracas to the high savannahs of Ocumare, passing by La Valle and Salamanca These savannahs themselves are beyond the Tuy; and the valley of the Tuy being a great deal lower than that of Caracas, the descent is almost constantly from north to south. As Cape Codera, the Silla, the Cerro de Avila between Caracas and La Guayra, and the mountains of Mariara, constitute the most northern and elevated range of the coast chain; so the mountains of Panaquire, Ocumare, Guiripa, and of the Villa de Cura, form the most southern range. The general direction of the strata composing this wast chain of the coast is from south-east to north-west; and the dip is generally towards north-west: hence it follows, that the direction of the primitive strata is independent of that of the whole chain. It is extremely remarkable,

[^134]tracing this chain* from Porto Cabello as far as Maniquarez and Macanao, in the island of Margareta, to find, from west to east, first granite, then gneiss, mica-slate, and primitive schist; and finally, compact limestone, gypsum, and conglomerates containing sea-shells.

It is to be regretted that the town of Caracas was not built farther to the east, below the entrance of the Anauco into the Guayra; on that spot near Chacao, where the valley widens into an extensive plain, which seems to have been levelled by the waters. Diego de Losada, when he founded $\dagger$ the town, followed no doubt the traces of the first establishment made by Faxardo. At that time, the Spaniards, attracted by the high repute of the two gold mines of Los Teques and Baruta, were not yet masters of the whole valley, and preferred remaining near the road leading to the coast. The town of Quito is also built in the narrowest and most uneven part of a valley, between two fine plains, Turupamba and Rumipamba.

The descent is uninterrupted from the custom-house of the Pastora, by the square of Trinidad and the Plaza Mayor, to Santa Rosalia, and the Rio Guayra. This declivity of the ground does not prevent carriages from going about the town; but the inhabitants make little use of them. Three small rivers, descending from the mountains, the Anauco, the Catuche, and the Caraguata, intersect the town, running from north to south. Their banks are very high; and, with the dried-up ravines which join them, furrowing the ground, they remind the traveller of the famous Guaicos of Quito, only on a smaller scale. The water used for drinking at Caracas is that of the Rio Catuche; but the rieher class of the inhabitants have their water brought from La Valle, a village a league distant on the south. This water and that of Gamboa are considered very salubrious, because they flow over the roots of sarsaparilla. $\ddagger$ I could not discover in

[^135]them any aromatic or extractive matter. The water of the valley does not contain lime, but a little more carbonic acid than the water of the Anauco. The new bridge over this river is a handsome structure. Caracas contains eight churches, five convents, and a theatre capable of holding fifteen or eighteen hundred persons. When I was there, the pit, in which the seats of the men are apart from those of the women, was uncovered. By this means the spectators could either look at the actors or gaze at the stars. As the misty weather made me lose a great many observations of Jupiter's satellites, I was able to ascertain, as I sat in a box in the theatre, whether the planet would be visible that night. The streets of Caracas are wide and straight, and they cross each other at right angles, as in all the towns built by the Spaniards in America. The houses are spacious, and higher than they ought to be in a country subject to earthquakes. In 1800, the two squares of Alta Gracia and San Francisco presented a very agreeable aspect; I say in the year 1800, because the terrible shocks of the 26th of March, 1812, almost destroyed the whole city, which is only now slowly rising from its ruins. The quarter of Trinidad, in which I resided, was destroyed as completely as if a mine had been sprung beneath it.

The small extent of the valley, and the proximity of the high mountains of Avila and the Silla, give a gloomy and stern character to the scenery of Caracas; particularly in that part of the year when the coolest temperature prevails, viz., in the months of November and December. The mornings are then very fine; and on a clear and serene sky we could perceive the two domes or rounded pyramids of the Silla, and the craggy ridge of the Cerro de Avila. But towards evening the atmosphere thickens; the mountains are overhung with clouds; streams of vapour cling to their evergreen slopes, and seem to divide them into zones one above another. These zones are gradually blended together; the cold air which descends from the Silla, accumulates in the valley, and condenses the light vapours into large fleecy clouds. These often descend below the Cross of La Guayra, and advance, gliding on the soil, in the direction of the Pastora of Magellan, that water is much praised which comes in contact with the roots of the Canella winterana.
of Caracas, and the adjacent quarter of Trinidad. Beneath this misty sky, I could scarcely imagine myself to be in one of the temperate valleys of the torrid zone; but rather in the north of Germany, among the pines and the larches that cover the mountains of the Hartz.

But this gloomy aspect, this contrast between the clearness of morning and the cloudy sky of evening, is not observable in the midst of summer. The nights of June and July are clear and delicious. The atmosphere then preserves, almost without interruption, the purity and transparency peculiar to the table-lands and elevated valleys of these regions in calm weather, as long as the winds do not mingle together strata of air of unequal temperature. That is the season for enjoying the beauty of the landscape, which, however, I saw clearly illumined only during a few days at the end of January. The two rounded summits of the Silla are seen at Caracas, almost under the same angles of elevation* as the peak of Teneriffe at the port of Orotava. The first half of the mountain is covered with short grass; then succeeds the zone of evergreen trees, reflecting a purple light at the season when the befaria, the alpine rose-treet $\dagger$ of equinoctial America, is in blossom. The rocky masses rise above this wooded zone in the form of domes. Being destitute of vegetation, they increase by the nakedness of their surface the apparent height of a mountain which, in the temperate parts of Europe, would scarcely rise to the limit of perpetual snow. The cultivated region of the valley, and the gay plains of Chacao, Petare, and La Vega, form an agreeable contrast to the imposing aspect of the Silla, and the great irregularities of the ground on the north of the town.

The climate of Caracas has often been called a perpetual spring. The same sort of climate exists everywhere, halfway up the Cordilleras of equinoctial America, between four hundred and nine hundred toises of elevation, except in places where the great breadth of the valleys, combined with an arid soil, causes an extraordinary intensity $\ddagger$ of radiant

[^136]+ Rhododendron ferrugincum of the Alps. $\ddagger$ As at Carthago and Ibague in New Grenada.
caloric. What can we conceive to be more delightful than a temperature which in the day keeps between $20^{\circ}$ and $26^{\circ}{ }^{\circ}$ * and at night between $16^{\circ}$ and $18^{\circ}, \dagger$ which is equally favourable to the plantain, the orange-tree, the coffee-tree, the apple, the apricot, and corn? Jose de Oviedo y Baños, the historiographer of Venezuela, calls the situation of Caracas that of a terrestrial paradise, and compares the Anauco and the neighbouring torrents to the four rivers of the Garden of Eden.

It is to be regretted that this delightful climate is generally inconstant and variable. The inhabitants of Caracas complain of having several seasons in one and the same day; and of the rapid change from one season to another. In the month of January, for instance, a night, of which the mean temperature is $16^{\circ}$, is sometimes followed by a day when the thermometer during eight successive hours keeps above $22^{\circ}$ in the shade. In the same day, we may find the temperature of $24^{\circ}$ and $18^{\circ}$. These variations are extremely common in our temperate climates of Europe, but in the torrid zone, Europeans themselves are so accustomed to the uniform action of exterior stimulus, that they suffer from a change of temperature of $6^{\circ}$. At Cumana, and everywhere in the plains, the temperature from eleven in the morning to eleven at night changes only $2^{\circ}$ or $3^{\circ}$. Moreover, these variations act on the human frame at Caracas more violently than might be supposed from the mere indications of the thermometer. In this narrow valley the atmosphere is in some sort balanced between two winds, one blowing from the west, or the seaside, the other from the east, or the inland country. The first is known by the name of the wind of Catia, because it blows from Catia westward of Cabo Blanco through the ravine of Tipe. It is, however, only a westerly wind in appearance, and it is oftener the breeze of the east and north-east, which, rushing with extreme impetuosity, engulfs itself in the Quebrada de Tipe. Rebounding from the high mountains of Aguas Negras, this wind finds its way back to Caracas, in the direction of the hospital of the Capuchins and the Rio Caraguata. It is loaded with vapours, which it deposits as its temperature decreases, and consequently the summit of the Silla is enveloped in

[^137]clouds, when the catia blows in the valley. This wind is dreaded by the inhabitants of Caracas; it causes headache in persons whose nervous system is irritable. In order to shun its effects, people sometimes shut themselves up in their houses, as they do in Italy when the sirocco is blowing. I thought I perceived, during my stay at Caracas, that the wind of Catia was purer (a little richer in oxygen) than the wind of Petare. I even imagined that its purity might explain its exciting property. The wind of Petare coming from the east and south-east, by the eastern extremity of the valley of the Guayra, brings from the mountains and the interior of the country, a drier air, which dissipates the clouds, and the summit of the Silla rises in all its beauty.

We know that the modifications produced by winds in the composition of the air in various places, entirely escape our eudiometrical experiments, the most precise of which can estimate only as far as $0008^{\circ}$ of oxygen. Chemistry does not yet possess any means of distinguishing two jars of air, the one filled during the prevalence of the sirocco or the catia, and the other before these winds have commenced. It appears to me probable, that the singular effects of the catia, and of all those corrents of air, to the influence of which popular opinion attaches so much importance, must be looked for rather in the changes of humidity and of temperature, than in chemical modifications. We need not trace miasms to Caracas from the unhealthy shore on the coast: it may be easily conceived that men accustomed to the drier air of the mountains and the interior, must be disagreeably affected when the very humid air of the sea, pressed through the gap of Tipe, reaches in an ascending current the high valley of Caracas, and, getting cooler by dilatation, and by contact with the adjacent strata, deposits a great portion of the water it contains. This inconstancy of climate, these somewhat rapid transitions from dry and transparent to humid and misty air, are inconveniences which Caracas shares in common with the whole temperate region of the tropicswith all places situated between four and eight hundred toises of elevation, either on table-lands of small extent, or on the slope of the Cordilleras, as at Xalapa in Mexico,
and Guaduas in New Granada. A serenity, uninterrupted during a great part of the year, prevails only in the low regions at the level of the sea, and at considerable heights on those vast table-lands, where the uniform radiation of the soil seems to contribute to the perfect dissolution of vesicular vapours. The intermediate zone is at the same height as the first strata of clouds which surround the surface of the earth; and the climate of this zone, the temperature of which is so mild, is essentially misty and variable.

Notwithstanding the elevation of the spot, the sky is generally less blue at Caracas than at Cumana. The aqueous vapour is less perfectly dissolved; and here, as in our climates, a greater diffusion of light diminishes the intensity of the aerrial colour, by introducing white into the blue of the air. This intensity, measured with the cyanometer of Saussure, was found from November to January generally $18^{\circ}$, never above $20^{\circ}$. On the coasts it was from $22^{\circ}$ to $25^{\circ}$. I remarked, in the village of Caracas, that the wind of Petare sometimes contributes singularly to give a pale tint to the celestial vault. On the 22nd of January, the blue of the sky was at noon in the zenith feebler than I ever saw it in the torrid zone.* It corresponded only to $12^{\circ}$ of the cyanometer. The atmosphere was then remarkably transparent, without clouds, and of extraordinary dryness. The moment the wind of Petare ceased, the blue colour rose at the zenith as high as $16^{\circ}$. I have often observed at sea, but in a smaller degree, a similar effect of the wind on the colour of the serenest sky.

We know less exactly the mean temperature of Caracas, than that of Santa Fé de Bogotá and of Mexico. I believe, however, I can demonstrate, that it cannot be very distant from twenty to twenty-two degrees. I found by my own observations, during the three very cool months of November, December, and January, taking each day the maximum and minimum of the temperature, the heights were $20.2^{\circ}$; $20 \cdot 1^{\circ} ; 20 \cdot 2^{\circ}$.

- At noon, thermometer in the shade $23.7^{\circ}$ (in the sun, out of the wind, $30.4^{\circ}$ ) ; De Luc's hygrometer, $36.2^{\circ}$; cyanometer, at the zenith, $12^{\circ}$, at the horizon $9^{\circ}$. The wind ceased at three in the afternoon. Therm. $21^{\circ}$; hygr. $39.3^{\circ}$; cyan. $16^{\circ}$. At six $0^{\prime}$ clock, therm. $20.2^{\circ}$; hygr. $39^{\circ}$.

Rains are extremely frequent at Caracas in the months of April, May, and June. The storms always come from the east and south-east, from the direction of Petare and La Valle. No hail falls in the low regions of the tropics; yet it occurs at Caracas almost every four or five years. Hail has even been seen in valleys still lower; and this phenomenon, when it does happen, makes a powerful impression on the people. Falls of aërolites are less rare with us than hail in the torrid zone, notwithstanding the frequency of thunder-storms at the elevation of three hundred toises above the level of the sea.

The cool and delightful climate we have just been describing is also suited for the culture of equinoctial productions. The sugar-cane is reared with success, even at heights exceeding that of Caracas; but in the valley, owing to the dryness of the climate, and the stony soil, the cultivation of the coffee-tree is preferred: it yields indeed but little fruit, but that little is of the finest quality. When the shrub is in blossom, the plain extending beyond Chacao presents a delightful aspect. The banana-tree, which is seen in the plantations near the town, is not the great Platano harton; but the varieties camburi and dominico, which require less heat. The great plantains are brought to the market of Caracas from the haciendas of Turiamo, situated on the coast between Burburata and Porto Cabello. The finest flavoured pine-apples are those of Baruto, of Empedrado, and of the heights of Buenavista, on the road to Victoria. When a traveller for the first time visits the valley of Caracas, he is agreeably surprised to find the culinary plants of our climates, as well as the strawberry, the vine, and almost all the fruit-trees of the temperate zone, growing beside the coffee and banana-tree. The apples and peaches esteemed the best come from Macarao, or from the western extremity of the valley. There, the quince-tree, the trunk of which attains only four or five feet in height, is so common, that it has almost become wild. Preserved apples and quinces, particularly the latter,* are much used in a country where it is thought that, before drinking water, thirst should be excited by sweetmeats. In proportion as the environs of the town have been planted with

* "Dulce de manzana y de membrillo," are the Spanish names of these preserves.
coffee, and the establishment of plantations (which dates only from the year 1795) has increased the number of agricultural negroes,* the apple and quince-trees scattered in the savannahs have given place, in the valley of Caracas, to maize and pulse. Rice, watered by means of small trenches, was formerly more common than it now is in the plain of Chacao. I observed in this province, as in Mexico and in all the elevated lands of the torrid zone, that, where the apple-tree is most abundant, the culture of the peartree is attended with great difficulty. I have been assured, that near Caracas the excellent apples sold in the markets come from trees not grafted. There are no cherry-trees. The olive-trees which I saw in the court of the convent of San Felipe de Neri, were large and fine; but the luxuriance of their vegetation prevented them from bearing fruit.

If the atmospheric constitution of the valley be favourable to the different kinds of culture on which colonial industry is based, it is not equally favourable to the health of the inhabitants, or to that of foreigners settled in the capital of Venezuela. The extreme inconstancy of the weather, and the frequent suppression of cutaneous perspiration, give birth to catarrhal affections, which assume the most various forms. A European, once accustomed to the violent heat, enjoys better health at Cumana, in the valley of Aragua, and in every place where the low region of the tropics is not very humid, than at Caracas, and in those mountain-climates which are vaunted as the abode of perpetual spring.

Speaking of the yellow fever of La Guayra, I mentioned the opinion generally adopted, that this disease is propagated as little from the coast of Venezuela to the capital, as from the coast of Mexico to Xalapa. This opinion is founded on the experience of the last twenty years. The contagious disorders which were severely felt in the port of La Guayra, were scarcely felt at Caracas. I am not convinced that the American typhus, rendered endemic on

[^138]the coast as the port becomes more frequented, if favoured by particular dispositions of the climate, may not become common in the valley: for the mean temperature of Caracas is considerable enough to allow the thermometer, in the hottest months, to keep between twenty-two and twentysix degrees. The situation of Xalapa, on the declivity of the Mexican mountains, promises more security, because that town is less populous, and is five times farther distant from the sea than Caracas, and two hundred and thirty toises higher: its mean temperature being three degrees cooler. In 1696, a bishop of Venezuela, Diego de Baños, dedicated a church (ermita) to Santa Rosalia of Palermo, for having delivered the capital from the scourge of the black vomit (vomito negro), which is said to have raged for the space of sixteen months. A mass celebrated every year in the cathedral, in the beginning of September, perpetuates the remembrance of this epidemic, in the same manner as processions fix, in the Spanish colonies, the date of the great earthquakes. The year 1696 was indeed very remarkable for the yellow fever, which raged with violence in all the West India Islands, where it had only begun to gain an ascendancy in 1688. But how can we give credit to an epidemical black vomit, having lasted sixteen months without interruption, and which may be said to have passed through that very cool season when the thermometer at Caracas falls to twelve or thirteen degrees? Can the typhus be of older date in the elevated valley of Caracas, than in the most frequented ports of Terra Firma. According to Ulloa, it. was unknown in Terra Firma before 1729. I doubt, therefore, the epidemic of 1696 having been the yellow fever, or real typhus of America. Some of the symptoms which accompany yellow fever are common to bilious remittent fevers; and are no more characteristic than homatemeses of that severe disease now known at the Havannah and Vera Cruz by the name of vomito. But though no accurate description satisfactorily demonstrates that the typhus of America existed at Caracas as early as the end of the seventeenth century, it is unhappily too certain, that this disease carried off in that capital a great number of European soldiers in 1802. We are filled with dismay when we reflect that, in the centre of the torrid zone, a table-land
four hundred and fifty toises high, but very near the sea, does not secure the inhabitants against a scourge which was believed to belong only to the low regions of the coast.

## Chapter XIII.

Abode at Caracas.-Mountains in the vicinity of the Town.-Excursion to the Summit of the Silla.-Indications of Mines.

I remained two months at Caracas, where M. Bonpland and I lived in a large house in the most elevated part of the town. From a gallery we could survey at once the summit of the Silla, the serrated ridge of the Galipano, and the charming valley of the Guayra, the rich culture of which was pleasingly contrasted with the gloomy curtain of the surrounding mountains. It was in the dry season, and to improve the pasturage, the savannahs and the turf covering the steepest rocks were set on fire. These vast conflagrations, viewed from a distance, produce the most singular effects of light. Wherever the savannahs, following the undulating slope of the rocks, have filled up the furrows hollowed out by the waters, the flame appears in a dark night like currents of lava suspended over the valley. The vivid but steady light assumes a reddish tint, when the wind, descending from the Silla, accumulates streams of vapour in the low regions. At other times (and this effect is still more curious) these luminous bands, enveloped in thick clouds, appear only at intervals where it is clear; and as the clouds ascend, their edges reflect a splendid light. These various phenomena, so common in the tropics, acquire additional interest from the form of the mountains, the direction of the slopes, and the height of the savannahs covered with alpine grasses. During the day, the wind of Petare, blowing from the east, drives the smoke towards the town, and diminishes the transparency of the air.

If we had reason to be satisfied with the situation of our house, we had still greater cause for satisfaction in the reception we met with from all classes of the inhabitants. Though I have had the advantage, which few Spaniards have
shared with me, of having successively visited Caracas, the Havannah, Santa Fé de Bogotá, Quito, Lima, and Mexico, and of having been connected in these six capitals of Spanish America with men of all ranks, I will not venture to decide on the various degrees of civilization, which society has attained in the several colonies. It is easier to indicate the different shades of national improvement, and the point towards which intellectual development tends, than to compare and class things which cannot all be considered under one point of view. It appeared to me, that a strong tendency to the study of science prevailed at Mexico and Santa Fé de Bogotá; more taste for literature, and whatever can charm an ardent and lively imagination, at Quito and Lima; more accurate notions of the political relations of countries, and more enlarged views on the state of colonies and their mother-countries, at the Havannah and Caracas. The numerous communications with commercial Europe, with the Caribbean Sea (which we have described as a Mediterranean with many outlets), have exercised a powerful influence on the progress of society in the five provinces of Venezuela and in the island of Cuba. In no other part of Spanish America has civilization assumed a more European character. The great number of Indian cultivators who inhabit Mexico and the interior of New Grenada, impart a peculiar, I may almost say, an exotic aspect, on those vast countries. Notwithstanding the increase of the black population, we seem to be nearer to Cadiz and the United States, at Caracas and the Havannah, than in any other part of the New World.

When, in the reign of Charles $V$, social distinctions and their consequent rivalries were introduced from the mothercountry to the colonies, there arose in Cumana and in other commercial towns of Terra Firma, exaggerated pretensions to nobility on the part of some of the most illustrious families of Caracas, distinguished by the designation of los Mantuanos. The progress of knowledge, and the consequent change in manners, have, however, gradually and pretty generally neutralized whatever is offensive in those distinctions among the whites. In all the Spanish colonies there exist two kinds of nobility. One is composed of creoles, whose ancestors only from a very recent period filled great stations
in America. Their prerogatives are partly founded on the distinction they enjoy in the mother-country; and they imagine they can retain those distinctions beyond the sea, whatever may be the date of their settlement in the colonies. The other class of nobility has more of an American character. It is composed of the descendants of the Conquistadores, that is to say, of the Spaniards who served in the army at the time of the first conquest. Among the warriors who fought with Cortez, Losada, and Pizarro, several belonged to the most distinguished families of the Peninsula; others, sprung from the inferior classes of the people, have shed lustre on their names, by that chivalrous spirit which prevailed at the beginning of the sixteenth century. In the records of those times of religious and military enthusiasm, we find, among the followers of the great captains, many simple, virtuous, and generous characters, who reprobated the cruelties which then stained the glory of the Spanish name, but who, being confounded in the mass, have not escaped the general proscription. The name of Conquistadores remains the more odious, as the greater number of them, after having outraged peaceful nations, and lived in opulence, did not end their career by suffering those misfortunes which appease the indignation of mankind, and sometimes soothe the severity of the historian.

But it is not only the progress of ideas, and the conflict between two classes of different origin, which have induced the privileged castes to abandon their pretensions, or at least cautiously to conceal them. Aristocracy in the Spanish colonies has a counterpoise of another kind, the action of which becomes every day more powerful. A sentiment of equality, among the whites, has penetrated every bosom. Wherever men of colour are either considered as slaves, or as having been enfranchised, that which constitutes nobility is hereditary liberty-the proud boast of having never reckoned among ancestors any but freemen. In the colonies, the colour of the skin is the real badge of nobility. In Mexico, as well as Peru, at Caracas as in the island of Cuba, a barefooted fellow with a white skin, is often heard to exclaim: "Does that rich man think himself whiter than I am?" The population which Europe pours into America being very considerable, it may easily be supposed, that the axiom,
'every white man is noble' (todo blanco es caballero), must singularly wound the pretensions of many ancient and illustrious European families. But it may be further observed, that the truth of this axiom has long since been acknowledtyed in Spain, among a people justly celebrated for probity, industry, and national spirit. Every Biscayan calls himself noble; and there being a greater number of Biscayans in America and the Philippine Isiands, than in the Peninsula, the whites of that race have contributed, in no small degree, to propagate in the colonies the system of equality among all men whose blood has not been mixed with that of the African race.

Moreover, the countries of which the inhabitants, even without a representative government, or any institution of peerage, annex so much importance to genealogy and the advantages of birth, are not always those in which family aristocracy is most offensive. We do not find among the natives of Spanish origin, that cold and assuming air which the character of modern civilization seems to have rendered less common in Spain than in the rest of Europe. Conviviality, candour, and great simplicity of manner, unite the different classes of society in the colonies, as well as in the mother-country. It may even be said, that the expression of vanity and self-love becomes less offensive, when it retains something of simplicity and frankness.

I found in several families at Caracas a love of information, an acquaintance with the masterpieces of French and Italian literature, and a marked predilection for music, which is greatly cultivated, and which (as always results from a taste for the fine arts) brings the different classes of society nearer to each other. The mathematical sciences, drawing, and painting, cannot here boast of any of those establishments with which royal munificence and the patriotic zeal of the inhabitants have enriched Mexico. In the midst of the marvels of nature, so rich in interesting productions, it is strange that we found no person on this coast devoted to the study of plants and minerals. In a Franciscan convent I met, it is true, with an old monk who drew up the almanac for all the provinces of Venezuela, and who possessed some accurate knowledge of astronomy. Our instruments interested him deeply, and one day our house
was filled with all the monks of San Francisco, begging to see a dipping-needle. The curiosity excited by physical phenomena is naturally great in countries undermined by volcanic fires, and in a climate where nature is at once so majestic and so mysteriously convulsed.

When we remember, that in the United States of North America, newspapers are published in small towns not containing more than three thousand inhabitants, it seems surprising that Caracas, with a population of forty or fifty thousand souls, should have possessed no printing office before 1806; for we cannot give the name of a printing establishment to a few presses which served only from year to year to promulgate an almanac of a few pages, or the pastoral letter of a bishop. Though the number of those who feel reading to be a necessity is not very considerable, even in the Spanish colonies most advanced in civilization, yet it would be. unjust to reproach the colonists for a state of intellectual lassitude which has been the result of a jealous policy. A Frenchman, named Delpeche, has the merit of having established the first printing office in Caracas. It appears somewhat extraordinary that an establishment of this kind should have followed, and not preceded, a political revolution.

In a country abounding in such magnificent scenery, and at a period when, nothwithstanding some symptoms of popular commotion, most of the inhabitants seem only to direct attention to physical objects, such as the fertility of the year, the long drought, or the conflicting winds of Petare and Catia, I expected to find many individuals well acquainted with the lofty surrounding mountains. But I was disappointed; and we could not find in Caracas a single person who had visited the summit of the Silla. Hunters do not ascend so high on the ridges of mountains; and in these countries journeys are not undertaken for such purposes as gathering alpine plants, carrying a barometer to an elevated point, or examining the nature of rocks. Accustomed to a uniform and domestic life, the people dread fatigue and sudden changes of climate. They seem to live not to enjoy life, but only to prolong it.

Our walks led us often in the direction of two coffee plantations, the proprietors of which, Don Andres de Ibarra
and M. Blandin, were men of agreeable manners. These plantations were situated opposite the Silla de Caracas. Surveying, by a telescope, the steep declivity of the mountains, and the form of the two peaks by which it is terminated, we could form an idea of the difficulties we should have to encounter in reaching its summit. Angles of elevation, taken with the sextant at our house, had led me to believe that the summit was not so high above sea-level as the great square of Quito. This estimate was far from corresponding with the notions entertained by the inhabitants of the city. Mountains which command great towns, have acquired, from that very circumstance, an extraordinary celebrity in both continents. Long before they have been accurately measured, a conventional height is assigned to them; and to entertain the least doubt respecting that height is to wound a national prejudice.

The captain-general, Señor de Guevara, directed the teniente of Chacao to furnish us with guides to conduct us on our ascent of the Silla. These guides were negroes, and they knew something of the path leading over the ridge of the mountain, near the western peak of the Silla. This path is frequented by smugglers, but neither the guides, nor the most experienced of the militia, accustomed to pursue the smugglers in these wild spots, had been on the eastern peak, forming the most elevated summit of the Silla. During the whole month of December, the mountain (of which the angles of elevation made me acquainted with the effects of the terrestrial refractions) had appeared only five times free of clouds. In this season two serene days seldom succeed each other, and we were therefore advised not to choose a clear day for our excursion, but rather a time when, the clouds not being elevated, we might hope, after having crossed the first layer of vapours uniformly spread, to enter into a dry and transparent air. We passed the night of the 2d of January in the Estancia de Gallegos, a plantation of coffee-trees, near which the little river of Chacaito, flowing in a luxuriantly shaded ravine, forms some fine cascades in descending the mountains. The night was pretty clear; and though on the day preceding a fatiguing journey it might have been well to have enjoyed some repose, M. Bonpland and I passed the whole night in watching three
vol. I.
occultations of the satellites of Jupiter. I had previously determined the instant of the observation, but we missed them all, owing to some error of calculation in the Connaissance des Temps. The apparent time had been mistaken for mean time.

I was much disappointed by this accident; and after having observed at the foot of the mountain the intensity of the magnetic forces, before sunrise, we set out at five in the morning, accompanied by slaves carrying our instruments. Our party consisted of eighteen persons, and we all walked one behind another, in a narrow path, traced on a steep acclivity, covered with turf. We endeavoured first to reach a hill, which towards the south-east seems to form a promontory of the silla. It is connected with the body of the mountain by a narrow dyke, called by the shepherds the Gate, or Puerta de la Silla. We reached this dyke about seven. The morning was fine and cool, and the sky till then seemed to favour our excursion. I saw that the thermometer kept a little below $14^{\circ}$ ( $11 \cdot 2^{\circ}$ Reaum.). The barometer showed that we were already six hundred and eighty-five toises above the level of the sea, that is, nearly eighty toises higher than at the Venta, where we enjoyed so magnificent a view of the coast. Our guides thought that it would require six hours more to reach the summit of the Silla.

We crossed a narrow dyke of roeks covered with turf; which led us from the promontory of the Puerta to the ridge of the great mountain. Here the eye looks down an two valleys, or rather narrow defiles, filled with thick vegetation. On the right is perceived the ravine which descends between the two peaks to the farm of Muñoz; on the left we see the defile of Chacaito, with its waters flowing out near the farm of Gallegos. The roaring of the cascades is hoard, while the water is unseen, being concealed by thick groves of erythrina, clusia, and the Indian fig-tree.* Nothing can be more picturesque, in a olimate where so many plants have broad, large, shining, and coriaceous leaves, than the aspect of trees when the spectator looks down from a great height above them, and when they are illumined by the almost perpendicular rays of the sun.

[^139]From the Puerta de la Silla the steepness of the ascent increases, and we were obliged to incline our bodies considerably forwards as we advanced. The slope is often from $.30^{\circ}$ to $32^{\circ}$. We felt the want of cramp-irons, or sticks shod with iron. Short grass cavered the rocks of gneiss, and it was equally impossible to hold by the grass, or to form steps as we might have done in softer ground. This ascent, which was attended with more fatigue than danger, discouraged those who accompanied us from the town, and who were unaccustomed to climb mountains. We lost a great deal of time in waiting for them, and we did not resolve to proceed alone till we saw them descending the mountain instead of climbing up it. The weather was becoming cloudy; the mist already issued in the form of moke, and in slender and perpendicular streaks, froma a small humid wood which bordered the region of alpine savannahs above us. It.seemed as if a fire had burst forth at once on several points of the forest. These streaks of vapour gradually accumulated together, and rising above the ground, were carried along by the morning breeze, and glided like a- light cloud over the rounded summit of the mountain.
M. Bonpland and I foresaw from these infallible signs, that we should soon be covered by a thick fog; and lest our guides should take advantage of this circumstance and leave us, we obliged those who carried the most necessary instruments to precede us. We continued climbing the slopes which lead towards the ravine of Chacaito. The familiar loquacity of the Creole blacks formed a striking contrast with the taciturn gravity of the Indians, who had constantly accompanied us in the missions of Caripe. The negroes amused themselves by laughing at the persons who had been in such haste to abandon an expedition so long in preparation; above all, they did not spare a young Capuchin monk, a professor of mathematics, who never ceased to boast of the superior physical strength and courage pos-

[^140]sessed by all classes of European Spaniards over those born in Spanish America. He had provided himself with long slips of white paper, which were to be cut, and flung on the savannah, to indicate to those who might stray behind, the direction they ought to follow. The professor had even promised the friars of his order to fire off some rockets, to announce to the whole town of Caracas that we had succeeded in an enterprise which to him appeared of the utmost importance. He had forgotten that his long and heavy garments would embarrass him in the ascent. Having lost courage long before the creoles, he passed the rest of the day in a neighbouring plantation, gazing at us through a glass directed to the Silla, as we climbed the mountain. Unfortunately for us, he had taken charge of the water and the provision so necessary in an excursion to the mountains. The slaves, who were to rejoin us, were so long detained by him, that they arrived very late, and we were ten hours without either bread or water.

The eastern peak is the most elevated of the two which form the summit of the mountain, and to this we directed :our course with our instruments. The hollow between these two peaks has suggested the Spanish name of Silla (saddle), which is given to the whole mountain. The narrow defile which we have already mentioned, descends from this hollow toward the valley of Caracas, commencing near the western dome. The eastern summit is accessible only by going first to the west of the ravine over the promontory of the Puerta, proceeding straight forward to the lower summit; and not turning to the east till the ridge, or the hollow of the Silla between the two peaks, is nearly reached. The general aspect of the mountain points out this path; the rocks being so steep on the east of the ravine that it would be extremely difficult to reach the summit of the Silla by ascending straight to the eastern dome, instead of going. by the way of the Puerta.
From the foot of the cascade of Chacaito to one thousand toises of elevation, we found only savannahs. Two small liliaceous plants, with yellow flowers,* alone lift up their heads, among the grasses which cover the rocks. A few

* Cypura martinicensis, and Sisyrinchium iridifolium. This last is found also near the Venta of La Guayra, at 600 toises of elevation.
brambles* remind us of the form of our European: vegetation. We in vain hoped to find on the mountains of Caracas, and subsequently on the back of the Andes, an eglantine near these brambles. We did not find one indigenous rose-tree in all South America, notwithstanding the analogy existing between the climates of the high mountains of the torrid zone and the climate of our temperate zone. It appears that this charming shrub is wanting in all the southern hemisphere, within and beyond the tropics. It was only on the Mexican mountains that we were fortunate enough to discover, in the nineteenth degree of latitude, American eglantines. $\dagger$

We were sometimes so enveloped in mist, that we could not, without difficulty, find our way. At this height there is no path, and we were obliged to climb with our hands, when our feet failed us, on the steep and slippery acclivity. A vein filled with porcelain-clay attracted our attention. $\ddagger$ It is of snowy whiteness, and is no doubt the remains of a decomposed feldspar. I forwarded a considerable portion of it to the intendant of the province. In a country where fuel is not scarce, a mixture of refractory earths may be useful, to improve the earthenware, and even the bricks. Every time that the clouds surrounded us, the thermometer sunk as low as $12^{\circ}$ (to $9 \cdot 6^{\circ} \mathrm{R}$.) ; with a serene sky it rose to $21^{\circ}$. These observations were made in the shade. But it is difficult, on such rapid declivities, covered with a dry, shining, yellow turf, to avoid the effects of radiant heat. We were at nine hundred and forty toises of elevation; and yet at the same height, towards the east, we perceived in a ravine, not merely a few solitary palm-trees, but a whole grove. It was the palma real; probably a species of the genus Oreodoxa. This group of palms, at so considerable

* Rubus jamaicensis.
+ M. Redouté, in his superb work on rose-trees, has given our Mexican eglantine, under the name of Rosier de Montezuma, Montezuma rose.
$\ddagger$ The breadth of the vein is three feet. This porcelain-clay, when moistened, readily absorbs oxygen from the atmosphere. I found, at Caracas, the residual nitrogen very slightly mingled with carbonic acid, though the experiment was made in phials with ground-glass stoppers, not filled with water.
an elevation, formed a striking contrast with the willows* scattered on the depth of the more temperate valley of Cacracas. We here discovered plants of European forms, situated below those of the torrid zone.

After proceeding for the space of four houss across the savannahs, we entered into a little wood composed of shrubs and small trees, called el Pejual; doubtless from the great abundance here of the pejoa (Gaultheria odorata), a plant with very odoriferous leaves. $\dagger$ The steepness of the mountain became less considerable, and we felt an indescribable pleasure in examining the plants of this region. Nowhere, perhaps, can be found collected together, in so small a space, productions so beautiful, and so remarkable in regard to the geography of plants. At the height of a thousand toises, the lofty savamnahs of the hills terminate in a zone of shrubs which, by their appearance, their tortuous branches, their stiff leaves, and the magnitude and beauty of their purple flowers, remind us of what is called, in the Cordillemes of the Andes, the vegetation of the paramos and the punas: $\ddagger$ We there find the family of the alpine rhododendrons, the thibaudias, the andromedas, the vacciniums, and those befarias with resinous leaves, which we have several times compared to the rhododendron of our European Alps.

Even when nature does not produce the same species in snalogous climates, either in the plains of isothermal parallele,§ or on tabledands, the temperature of which ro-

[^141]sembles that of places nearer the poles,* we still remark a striking resemblance of appearance and physiognomy in the vegetation of the most distant countries. This phenomenon is one of the most curious in the history of organic forms. I say the history; for in vain would reason forbid man to form hypotheses on the origin of things; he still goes on puzzling himself with insoluble problems relating to the distribution of beings.

A gramen of Switzerland grows on the granitic rocks of the straits of Magellan. $\dagger$ New Holland contains above forty European phanerogamous plants: and the greater number of those plants, which are found equally in the temperate zones of both hemispheres, are entirely wanting in the intermediary or equinoctial region, as well in the plains as on the mountains. A downy-leaved violet, which terminates in some sort the zone of the phanerogamous plants at Teneriffe, and which was long thought peculiar to that island, $\ddagger$ is seen three hundred leagues farther north, near the snowy summit of the Pyrenees. Gramina and cyperaceous plants of Germany, Arabia, and Senegal, have

[^142]been recognized among those that were gathered by M. Bonpland and myself on the cold table-lands of Mexico, along the burning shores of the Orinoco, and in the southern hemisphere on the Andes and Quito." How can we conceive the migration of plants through regions now covered by the ocean? How have the germs of organic life, which resemble each other in their appearance, and even in their internal structure, unfolded themselves at unequal distances from the poles and from the surface of the seas, wherever places so distant present any analogy of temperature? Notwithstanding the influence exercised on the vital functions of plants by the pressure of the air, and the greater or less extinction of light, heat, unequally distributed in different seasons of the year, must doubtless be considered as the most powerful stimulus of vegetation.

The number of identical species in the two continents and in the two hemispheres is far less than the statements of early travellers would lead us to believe. The lofty mountains of equinoctial America have certainly plantains, valerians, arenarias, ranunculuses, medlars, oaks, and pines, which from their physiognomy we might confound with those of Europe; but they are all specifically different. When nature does not present the same species, she loves to repeat the same genera. Neighbouring species are often placed at enormous distances from each other, in the low regions of the temperate zone, and on the alpine heights of the equator. At other times (and the Silla of Caracas affords a striking example of this phenomenon), they are not the European genera, which have sent species to people like colonists the mountains of the torrid zone, but genera of the same tribe, difficult to be distinguished by their appearance, which take the place of each other in different latitudes.

The mountains of New Grenada surrounding the tablelands of Bogotá are more than two hundred leagues distant from those of Caracas, and yet the Silla, the only elevated peak in the chain of low mountains, presents those singular groupings of befarias with purple flowers, of

[^143]andromedas, of gualtherias, of myrtilli, of woas camaronas,* of nerteras, and of aralias with hoary leaves, $t$ which characterize the vegetation of the paramos on the high Cordilleras of Santa Fé. We found the same Thibaudia glandulosa at the entrance of the table-land of Bogotá, and in the Pejual of the Silla. The coast-chain of Caracas is unquestionably connected (by the Torito, the Palomera, Tocuyo, and the paramos of Rosas, of Bocono, and of Niquitao) with the high Cordilleras of Merida, Pamplona, and Santa Fé; but from the Silla to Tocuyo, along a distance of seventy leagues, the mountains of Caracas are so low, that the shrubs of the family of the ericineous plants, just cited, do not find the cold climate which is necessary for their development. Supposing, as is probable, that the thibaudias and the rhododendron of the Andes, or befaria, exist in the paramo of Niquitao and in the Sierra de Merida, covered with eternal snow, these plants would nevertheless want a ridge sufficiently lofty and long for their migration towards the Silla of Caracas.

The more we study the distribution of organized beings on the globe, the more we are inclined, if not to abandon the ideas of migration, at least to consider them as hypotheses not entirely satisfactory. The chain of the Andes divides the whole of South America into two unequal longitudinal parts. At the foot of this chain, on the east and west, we found a great number of plants specifically the same. The various passages of the Cordilleras nowhere permit the vegetable productions of the warm regions to proceed from the coats of the Pacific to the banks of the Amazon. When a peak attains a great elevation, either in the middle of very low mountains and plains, or in the centre of an archipelago heaved up by volcanic fires, its summit is covered with alpine plants, many of which are again found, at immense distances, on other mountains

[^144]having an analogous climate. Such are the general phenomena of the distribution of plants.

It is now said that a mountain is high enough to enter into the limits of the rhododendrons and the befarias, as it. has long been said that such a mountain reached the limit of perpetual snow. In using this expression, it is tacitly admitted, that under the influence of certain temperatures, certain vegetable forms must necessarily be developed. Such a supposition, however, taken in all its generality, is not strictly accurate. The pines of Mexico are wanting on the Cordilleras of Peru. The Silla of Caracas is not covered with the oaks which flourish in New Grenada at the.seme height. Identity of forms indicates an analogy of climate; but in similar climates the species may be singularly diversified.

The charming rhododendron of the Andes (the befaria) was first described by M. Mutis, who observed it near Pamplona and Santa Fé de Bogotá, in the fourth and seventh degree of north latitude. It was so little known before our expedition to the Silla, that it was scarcely to be found in any herbal in Europe. The learned editors of the Flora of Peru had even described it under another name, that of acunna. In the same manner as the rhododendrons of Lapland, Caucasus, and the Alps* differ from each other, the two species of befaria we brought from the Silla $\dagger$ are also specifically different from that of Santa Fé and Bogotá. $\ddagger$ Near the equator the rhododendrans of the Andes§ cover the mountains as far as the highest paramos, at sixteen and seventeen hundred toises of elevation. Advancing northward, on the Silla do Caracas, we find them much lower, a little below one thorsand toises. The befaria recently discovered in Florida, in latitude $30^{\circ}$, grows even on hills of small elevation. Thus in a space of six hundred leagues in latitude, these shrubs descend towards the plains in proportion as their distance

* Rhododendron lapponicum, R. caucasicum, R. ferragineum, and R. hirsutum.
$\dagger$ Befaria glanca, B. ledifolia.
$\ddagger$ Befaria exstuans, and B. resinosa.
§ Particularly B. æestuans of Mutis, and two new species of the southern hemisphere, which we have described under the name of B. coarctata, and B. grandifiora.
from the equator augments. The rhododendron of Lapland grows also at eight or nine hundred toises lower than the rhododendron of the Alps and the Pyrenees. We were surprised at not meeting with any species of befaria in the mountains of Mexico, between the rhododendrons of Santa Fé and Caracas, and those of Florida.

In the small grove which crowns the Silla, the Befaria ledifolia is only three or four feet high. The trunk is divided from its root into a great many slender and even verticillate branches. The leaves are oval, lanceolate, glaucous on their inferior part, and curled at the edges. The whole plant is covered with long and viscous hairs, and emits a very agreeable resinous smell. The bees visit its fine purple flowers, which are very abundant, as in all the alpine plants, and, when in full blossom, they are often nearly an inch wide.

The rhododendron of 'Switzertand, in those places where it grows, at the elevation of between eight hundred and a thousand toises, belongs to a climate, the mean temperature of which is $+2^{\circ}$ and $-1^{\circ}$, like that of the plains of Lapland. In this zome the coldest months are $-4^{\circ}$, and $-10^{\circ}$ : the hottest, $12^{\circ}$ and $7^{\circ}$. Thermometrical observations, made at the same heights and in the same latitudes, render it probable that, at the Pejual of the Silla, one thousand toises above the Caribbean Sea; the mean temperature of the air is still $17^{\circ}$ or $18^{\circ}$; and that the thermometer keeps, in the coolest season, between $15^{\circ}$ and $20^{\circ}$ in the day, and in the night between $10^{\circ}$ and $12^{\circ}$. At the hospital of St. Gothard, situated nearly on the highest limit of the rhododendron of the Alps, the maximum of heat, in the month of August at noon, in the shade, is usually $12^{\circ}$ or $13^{\circ}$; in the night, at the same season, the air is cooled by the radiation of the soil down to $+1^{\circ}$ or $-1.5^{\circ}$. Under the same barometric pressure, consequently at the same height, but thirty degrees of latitude nearer the equator, the befaria of the Silla is often, at noon, in the sun, exposed to a heat of $23^{\circ}$ or $24^{\circ}$. The greatest nocturnal refrigeration probably never exceeds $7^{\circ}$. We have carefully compared the climate, under the influence of which, at different latitudes, two groups of plants of the same family vegetate at equal heights above the level of the sea. The results would have been far different, had we com-
pared zones equally distant, either from the perpetual snow, or from the isothermal line of $0^{\circ}$.*

In the little thicket of the Pejual, near the purple-flowered befaria, grows a heath-leaved hedyotis, eight feet high; the caparosa, $\dagger$ which is a large arborescent hypericum; a lepidium, which appears identical with that of Virginia; and lastly, lycopodiaceous plants and mosses, which cover the rocks and roots of the trees. That which gives most celebrity in the country to the little thicket, is a shrub ten or fifteen feet high, of the corymbiferous family. The Creoles call it incense (incienso). $\ddagger$ Its tough and crenate leaves, as well as the extremities of the branches, are covered with a white wool. It is a new species of Trixis, extremely resinous, the flowers of which have the agreeable odour of storax. This smell is very different from that emitted by the leaves of the Trixis terebinthinacea of the mountains of Jamaica, opposite to those of Caracas. The people sometimes mix the incienso of the Silla with the flowers of the pevetera, another composite plant, the smell of which resembles that of the heliotropium of Peru. The pevetera does not, however, grow on the mountains so high as the zone of the befarias; it vegetates in the valley of Chacao, and the ladies of Caracas prepare from it an extremely pleasant odoriferous water.

We spent a long time in examining the fine resinous and fragrant plants of the Pejual. The sky became more and more cloudy, and the thermometer sank below $11^{\circ}$, a temperature at which, in this zone, people begin to suffer from the cold. Quitting the little thicket of alpine plants, we found ourselves again in a savannah. We climbed over a part of the western dome, in order to descend into the hollow of the Silla, a valley which separates the two summits of the

[^145]mountain. We there had great difficulties to overcome, occasioned by the force of the vegetation. A botanist would not readily guess that the thick wood covering this valley is formed by the assemblage of a plant of the musaceous family.* It is probably a maranta, or a heliconia; its leaves are large and shining; it reaches the height of fourteen or fifteen feet, and its succulent stalks grow near one another like the stems of the reeds found in the humid regions of the south of Europe. $\dagger$ We were obliged to cut our way through this forest. The negroes walked before. with their cutlasses or machetes. The people confound this alpine scitamineous plant with the arborescent gramina, under the name of carice. We saw neither its fruit nor flowers. We are surprised to meet with a monocotyledonous family, believed to be exclusively found in the hot and low regions of the tropics, at eleven hundred toises of elevation; much higher than the andromedas, the thibaudias, and the rhododendron of the Cordilleras. $\ddagger$ In a chain of mountains no less elevated, and more northern (the Blue Mountains of Jamaica), the Heliconia of the parrots and the bihai, rather grow in the alpine shaded situations.§

Wandering in this thick wood of musaceæ or arborescent plants, we constantly directed our course towards the eastern peak, which we perceived from time to time through an opening. On a sudden we found ourselves enveloped in a thick mist; the compass alone could guide us; but in advancing northward we were in danger at every step of finding ourselves on the brink of that enormous wall of rocks, which descends almost perpendicularly to the depth of six thousand feet towards the sea. We were obliged to halt. Surrounded by clouds sweeping the ground, we began to doubt whether we should reach the eastern peak before night. Happily, the negroes who carried our water and provisions, rejoined us, and we resolved to take some refreshment. Our repast did not last long. Possibly the Capuchin father had not thought of the great number of persons who

[^146]accompanied us, or perhaps the slaves had made free with our provisions on the way; be that as it may, we found nothing but olives, and scarcely any bread. Horace, in his retreat at Tibur, never boasted of a repast more light and frugal ; but clives, which might have afforded a satisfactory meal to a poet, devoted to study, and leading a sedentary life, appeared an aliment by no means sufficiently substantial for travellers climbing mountains. We had watched the greater part of the night, and we walked for nine hours without finding a single spring. Our guides were diseonraged; they wished to go back, and we had great difficulty in preventing them.

In the midat of the mist I made trial of the electrometer of Volta, armed with a smoking match. Though very near a thick wood of heliconias, I obtained very sensible signs of atmospheric electricity. It often varied from positive to negative, its intensity changing every instant. These variations, and the conflict of several small currents of air, which divided the mist, and transformed it into clouds, the borders of which were visible, appeared to me infallible prognostics of a change in the weather. It was only two o'cloek in the afternoon; we entertained some hope of reaching the eastern summit of the Silla before sunset, and of re-descending into the valley separating the two peaks, intending there to pass the night, to light a great fire, and to make our negroes construct a hut with the leaves of the heliconia. We sent off half of our servants with orders to hasten the next morning to meet us, not with olives, hut with a supply of salt beef.

We had scarcely made these arrangements when the east wind began to blow violently from the sea. The thermometer rose to $12.5^{\circ}$. It was no doubt an ascending wind, which, by heightening the temperature, dissolved the vapours. In less than two minutes the clouds dispersed, and the two domes of the Silla' appeared to us singularly near. We opened the barometer in the lowest part of the hollow that separates the two summits, near a little pool of very mucdy water. Here, as in the West India Islands, marshy plains are found at great elevations; not because the woody mountains attract the clouds, but because they condense the vapours by the effect of nocturnal refrigeration, occasioned
by, the radiation of heat from the ground, and from the paronchyma of the leaves. The mercury was at 21 inches $5 \cdot 7$ lines. We shaped our course direct to the eastern summit. The obstruction caused by the vegetation gradually diminished; it was, however, necessary to cut down some heliconias; but these arborescent plants were not now very thick or high. The peaks of the Silla themselves, as we have several times mentioned, are covered only with gramina and small shrubs of befaria. Their barrenness, however, is not owing to their height: the limit of trees in this region is four hundred toises higher; since, judging according to the analogy of other mountains, this limit would be found here only at a height of eighteen hundred toises. The absence of large trees. on the two rocky summits of the Sille may be attributed to the aridity of the soil, the violence of the winds blowing from the sea, and the conflagrations so frequent in all the moumtains of the equinoctial region.

To reach the eastern peak, which is the highest, it is necessary to approach as near as possible the great precipice which descends towards Caravalleda and the coast. The gneiss as far as this spot preserves its lamellar texture and its primitive direction; but where we climbed the summit of the Silla, we found it had passed into granite. Its textare becomes granular; the mica, less frequent, is more unequally spread through the rock. Instead of garnets we met with a few solitary crystals of hornblende. It is, however, not a syenite, but rather a granite of new formation. We were three quarters of an hour in reaching the summit of the pyramid. This part of the way is not dangerous, provided the traveller carefully examines the stability of each fragment of rock on which he places his foot. The granite superposed on the gneiss does not present a regular separation into beds: it is divided by clefts, which aften cross one another at right angles. Prismatic blocks, one foot wide and twelve long, stand out from the ground obliquely, and appear on the edges of the precipice like enormous beams suspended over the abyss.

Haring arrived at the summit, we enjoyed, for a few minutes only, the serenity of the sky. The eye ranged over a vast extent of country: looking down to the north
was the sea, and to the south, the fertile valley of Caracas. The barometer was at 20 inches 7.6 lines; the thermiometer at $13.7^{\circ}$. We were at thirteen hundred and fifty toises of elevation. We gazed on an extent of sea, the radius of which was thirty-six leagues. Persons who are affected by looking downward from a considerable height should remain at the centre of the small flat which crowns the eastern summit of the Silla. The mountain is not very remarkable for height: it is nearly eighty toises lower than the Canigou; but it is distinguished among all the mountains I have visited by an enormous precipice on the side next the sea. The coast forms only a narrow border ; and looking from the summit of the pyramid on the houses of Caravalleda, this wall of rocks seems, by an optical illusion, to be nearly perpendicular. The real slope of the declivity appeared to me, according to an exact calculation; $53^{\circ} 28^{*}$ The mean slope of the peak of Teneriffe is scarcely $12^{\circ} 30$. A precipice of six or seven thousand feet, like that of the Silla of Caracas, is a phenomenon far more rare than is generally believed by those who cross mountains without measuring their height, their bulk, and their slope. Since the experiments on the fall of bodies, and on their devistion to the south-east, have been resumed in several parts of Europe, a rock of two hundred and fifty toises of perpendicular elevation has been in vain sought for among all the Alps of Switzerland. The declivity of Mont Blanc towards the Allée Blanche does not even reach an angle of $45^{\circ}$; though in the greater number of geological works, Mont Blanc is described as perpendicular on the south side.

At the Silla of Caracas, the enormous northern cliff is partly covered with vegetation, notwithstanding the extreme steepness of its slope. Tufts of befaria and andromedas appear as if suspended from the rock. The little valley which separates the domes towards the south, stretches in the direction of the sea. Alpine plants fill this hollow; and, not confined to the ridge of the mountain, they follow the sinuosities of the ravine. It would seem as if torrents

[^147]were concealed under that fresh foliage; and the disposition of the plants, the grouping of so many inanimate objects, give the landscape all the charm of motion and of life.

Seven months had now elapsed since we had been on the summit of the peak of Teneriffe, whence we surveyed a
: space of the globe equal to a fourth part of France. The apparent horizon of the sea is there six leagues farther distant than at the top of the Silla, and yet we saw that horizon, at least for some time, very distinctly. It. was strongly marked, and not confounded with the adjacent strata of air. At the Silla, which is five hundred and fifty toises lower than the peak of Teneriffe, the horizon, though nearer, continued invisible towards the north and north-north-east. Following with the eye the surface of the sea, which was smooth as glass, we were struck with the progressive diminution of the reflected light. Where the visual ray touched the last limit of that surface, the water was lost. among the superposed strata of air. This appearance has something in it very extraordinary. We expect to see the horizon level with the eye; but, instead of distinguishing at this height a marked limit between the two elements, the more distant strata of water seem to be transformed into vapour, and mingled with the aërial ocean. I observed the same appearance, not in one spot of the horizon alone, but on an extent of more than a hundred and sixty degrees, along the Pacific, when I found myself for the first time on the pointed rock that commands the crater of Pichincha; a volcano, the elevation of which exceeds that of Mont Blanc.* The visibility of a very distant horizon depends, when there is no mirage, upon two distinct things: the quantity of light received on that part of the sea where the visual ray terminates; and the extinction of the reflected light during its passage through the intermediate strata of air. It may happen, notwithstanding the serenity of the sky and the transparency of the atmosphere, that the ocean is $\cdot$ feebly illuminated at thirty or forty leagues' distance; or that the strata of air nearest the earth may extinguish a great deal of the light, by absorbing the rays that traverse them.

The rounded peak, or western dome of the Silla, con-

[^148]vol. 1.
cealed from us the view of the town of Caracas; but we distinguished the nearest houses, the villages of Chacao and Petare, the coffee plantations, and the course of the Rio Guayra, a slender streak of water reflecting a silvery light. The narrow band of cultivated ground was pleasingly contrasted with the wild and gloomy aspect of the neighbouring mountains. Whilst contemplating these grand scenes, we feel little regret that the solitudes of the New Wonld are not embellished with the monuments of antiquity.

But we could not long avail ourselves of the advantage arising from the position of the Silla, in commanding all the neighbouring summits. While we were examining with our glasses that part of the sea, the horizon of which was clearly defined, and the chain of the mountains of Ocumare, behind which begins the unknown world of the Orinoco and the Amazon, a thick fog from the plains rose to the elevated regions, first filling the bottom of the valley of Caracas. The vapours, illumined from above, presented a uniform tint of a milky white. The valley seemed overspread with water, and looked like an arm of the sea, of which the adjacent mountains formed the steep shore. In vain we waited for the slave who carried Ramsden's great sextant. Eager to avail myself of the favourable state of the sky, I resolved to take a few solar altitudes with a sextant by Troughton of two inches radius. The disk of the sun was half-concealed by the mist. The difference of longitude between the quarter of the Trinidad and the eastern peak of the Silla appears scarcely to exceed $0^{\circ} 3^{\prime} \quad 22^{\prime \prime \prime}$.

Whilst, seated on the rock, I was determining the dip of the needle, I found my hands covered with a species of hairy bee, a little smalter than the honey-bee of the north of Turope. These insects make their nests in the ground. They seldom fly; and, from the slowness of their movemente, I should have suppesed they were benumbed by the cold of the mountains. The people, in these regions, call them angelitos (little angels), because they very seldom sting. They are no doubt of the genus Apis, of the division melipones. It has been erroneously affirmed that thess

[^149]beem, which are peculiar to the New World, are destitute of all offensive weapons. Their sting is indeed comparatively feeble, and they use it seldom; but a person, not fully convinced of the harmlessness of these angelitos, can scarcely divest himself of a sensation of fear. I must confess, that, whilst engaged in my astronomical observations, I was often on the point of letting my instruments fall, when I felt my hands and face covered with these hairy bees. Our guides assured us that they attempt to defend themselves only when irritated by being seized by their legs. I was not tempted to try the experiment on myself.

The dip of the needle at the Silla was one centesimal degree less than in the town of Caracas. In collecting the observations which I made during calm weather and in very favourable circumstances, on the mountains as well as along the coast, it would at first seem, that we discover, in that part of the globe, a certain influence of the heights on the dip of the needle, and the intensity of the magnetical forces; but we must remark, that the dip at Caracas is much greater than could be supposed, from the situation of the town, and that the magnetical phenomena are modified by the proximity of certain rocks, which constitute so many particular centres or little systems of attraction.*

The temperature of the atmosphere varied ion the summit of the Silla from eleven to fourteen degrees, according as the weather was calm or windy. Eyery one knows how difficult it is to verify, on the summit of a mountain, the temperature, which is to serve for the barometric calcula. tion. The wind was east, which would seem to prove that the trade-winds, extend in this latitude much higher thwn fifteen hundred toises. Von Buch had observed that, at the peak of Teneriffe, near the northern limit of the trade-winds, there exists generally at the elevation of one thousand nime hundred toises, a contrary current from the

[^150]west. The Academy of Sciences recommended the men of science who accompanied the unfortunate La Pérouse, to employ small air-balloons for the purpose of ascertaining at sea the extent of the trade-winds within the tropics. Such experiments are very difficult. Small balloons do not in general reach the height of the Silla; and the light clouds which are sometimes perceived at an elevation of three or four thousand toises, for instance, the fleecy clouds, called by the French moutons, remain almost fixed, or have such a slow motion, that it is impossible to judge of the direction of the wind.

During the short space of time that the sky was serene at the zenith, I found the blue of the atmosphere sensibly deeper than on the coasts. It is probable that, in the months of July and August, the difference between the colour of the sky on the coasts and on the summit of the Silla is still more considerable, but the meteorological phenomenon with which M. Bonpland and myself were most struck during the hour we passed on the mountain, was the apparent dryness of the air, which seemed to increase as the fog augmented.

This fog soon became so dense that it would have been imprudent to remain longer on the edge of a precipice of seven or eight thousand feet deep.* We descended the eastern dome of the Silla, and gathered in our descent a gramen, which not only forms a new and very remarkable genus, but which, to our great astonishment, we found again some time after on the summit of the volcano of Pichincha, at the distance of four hundred leagues from the Silla, in the southern hemisphere.t The Lichen floridus, so common in the north of Europe, covered the branches of the befaris and the Gualtheria odorata, descending even to the roots of these shrubs. Examining the mosses which cover the rocks of gneiss in the valley between the two peaks, I was surprised at finding real pebbles,-rounded fragments of

[^151]$=$ quartz.* It may be conceived that the valley of Caracas was once an inland lake, before the Rio Guayra found an issue to the east near Caurimare, at the foot of the hill of Auyamas, and before the ravine of Tipe opened on the west, in the direction of Gatia and Cabo Blanco. But how can we imagine that these waters could ascend as high as the Silla, when the mountains opposite this peak, those of Ocumare, were too low to prevent their overflow into the llanos? The pebbles could not have been brought by torrents from more elevated points, since there is no height that commands the Silla. Must we admit that they have been heaved up, like all the mountains which border the coast.

It was half after four in the afternoon when we finished our observations. Satisfied with the success of our journey, we forgot that there might be danger in descending in the dark, steep declivities covered by a smooth and slippery turf. The mist concealed the valley from us; but we distinguished the double hill of La Puerta, which, like all objects lying almost perpendicularly beneath the eye, appeared extremely near. We relinquished our design of passing the night between the two summits of the Silla, and having again found the path we had cut through the thick wood of heliconia, we soon arrived at the Pejual, the region of odoriferous and resinous plants. The beauty of the befarias, and their branches covered with large purple flowers, again rivetted our attention. When, in these climates, a botanist gathers plants to form his herbal, he becomes difficult in his choice in proportion to the luxuriance of vegetation. He casts away those which have been first cut, because they appear less beautiful than those which were out of reach. Though loaded with plants before quitting the Pejual, we still regretted not having made a more ample harvest. We tarried so long in this spot, that night surprised us as we entered the savannah, at the elevation of upwards of nine hundred toises.

As there is scarcely any twilight in the tropics, we pass suddenly from bright daylight to darkness. The moon was on the horizon; but her disk was reiled from time to time

[^152]by thick clouds, drifted by a cold and rough wind. Rapia slopes, covered with yellow and dry grass, now seen in shade, and now suddenly illumined, seemed like precipices, the depth of which the eye sought in vain to measure. We proceeded onwards, in single file, and endeavoured to support ourselves by our hands, lest we should roll down. The guides, who carried our instruments, abandoned us successively, to sleep on the mountain. Among those who remained with us was a Congo black, who evineed great address, bearing on his head a large dipping-needle: he held it constantly steady, notwithstanding the extreme declivity of the rocks. The fog had dispersed by degrees in the bottom of the valley; and the scattered lights we perceived below us caused a double illusion. The steeps appeared still more dangerous than they really were; and, during six hours of continual descent, we seemed to be always equally near the farms at the foot of the Silla. We heard very distinctily the voices of men and the notes of guitars. Sound is generally so well propagated upwards, that in a balloon at the elevation of three thousand toises, the barkiag of dogs is sometimes heard.*

We did not arrive till ten at night at the bottom of the valley. We were overeome with fatigue and thirst, haring walked for fifteen hours, nearly without stopping. The seles of our feet were cut and torn by the asperities of a rocky seil and the hard and dry stalks of the gramina, for we had been obliged to pull off our boots, the soles having become too slippery. On declivities devoid of shrubs or ligneous herbs, which may be grasped by the hand, the danger of the descent is diminished by walking barefoot. In order to shorten the way, our guides conducted us from the Puerta de la Silla to the farm of Gallegos by a path leading to a reservoir of water, called el Tanque. They missed their way, however; and this last descent, the steepest of all, brought us near the ravine of Chacaito. The noise of the cascades gave this nocturnal scene a grand and wild character.

We passed the night at the foot of the Silla. Our friends at Caracas had been able to distinguish us with glasses on

[^153]the summit of the eastern peak. They felt interested in hearing the account of our expedition, but they were not satisfied with the result of our measurement, which did not assign to the Silla. even the elevation of the highest summit of the Pyrenees." One cannot blame the national feeling which suggeste exaggerated ideas of the monumente of nature, in a country in which the monuments of art are nothing; nor can we wonder that the inhabitants of Quito and Riobamba, who have prided themselves for ages on the height of Chimborazo, mistrust those measurements which elevate the mountains of Himalaya above all the coloseal Cordilleras?

During our journey to the Silla, and in all our excursions in the valley of Caracas, we were very attentive to thie lodes and indications of ore which we found in the strats of gneiss. No regular diggings having been made, we could only examine the fissures, the ravines, and the land-slips. occasioned by torrents in the rainy season. The rock of gneiss, passing sometimes into a granite of new formation, sometimes into mica-slate, $\dagger$ belongs in Germany to the most metalliferous rocks; but in the New Continent; the gneiss has not hitherto beon remarked as very rich in ores worth working. The most celebrated mines of Mexico and Peru are found in the primitive and transition schists; in the trap-porphyries, the grauwakke, and the alpine limestones. In several spots of the valley of Caracas, the gneiss contains a small quantity of gold, disseminated in small veins of quartz, sulphuretted silver, asure copper-ore, and galena; but it is doubtful whether these different metalliferous substances are not too poor to encourage any attempt at working them. Such attempts were, however, made at the conquest of the province, about the middle of the sixteenth century.

From the promontory of Paria to beyond cape Vela, the early navigators had seen gold ornaments and gold dust, in the possession of the inhabitants of the coast. They penetrated into the interior of the country, to discover whence the

[^154]precious metal came; and though the information obtained in the province of Coro, and the markets of Curiana and Cauchieto,* clearly proved that real mineral wealth was to be found only to the west and south-west of Coro (that is to say, in the mountains near those of New Grenada), the whole province of Caracas was nevertheless eagerly explored. A governor, newly arrived on that coast, could recommend himself to the Spanish court only by boasting of the mines of his province; and in order to take from cupidity what was most ignoble and repulsive, the thirst of gold was justified by the purpose to which it was pretended the riches acquired by fraud and violence might be employed. "Gold," says Christopher Columbus, in his last letter $\dagger$ to King Ferdinand, "gold. is a thing so much the more necessary to your majesty, because, in order to fulfil the ancient prophecy, Jerusalem is to be rebuilt by a prince of the Dpanish monarchy. Gold is the most excellent of metals. What becomes of those precious stones, which are sought for at the extremities of the globe? They are sold, and are finally converted into gold. With gold we not only do whatever we please in this world, but we can even employ, it to snatch souls from Purgatory, and to people Paradise." These words bear the stamp of the age in which Columbus lived; but we are surprised to see this pompous eulogium of riches written by a man whose whole life was marked by the most noble disinterestedness. *

The conquest of the province of Venezuela having been begun at its western extremity, the neighbouring mountains of Coro, Tocuyo, and Barquisimeto, first attracted the at-
*The Spaniards found, in 1500, in the country of Curiana (now Coro), little birds, frogs, and other ornaments made of gold. Those who had cast

- these figures lived at Cauchieto, a place nearer the Rio de la Hacha. I have seen ornaments resembling those described by Peter Martyr of Anghiera (which indicate tolerable skill in goldsmiths' work), among the remains of the ancient inhabitants of Cundinamarca. The same art appears to have been practised in places along the coasts, and also farther to the south, among the mountains of New Grenada.
+ Lettera rarissima data nelle Indie nella isola di Jamaica a 7 Julio del 1503.-"Le oro è metallo sopra gli altri excellentissimo ; e dell' oro si fanno li tesori e chi lo tiene fa e opera quanto vaole nel mondo, e finalmente aggionge a mandare le anime al Paradiso."
tention of the Conquistadores. These mountains join the Cordilleras of New Grenada (those of Santa Fé, Pamplona, la Grita, and Merida) to the littoral chain of Caracas. It is a land the more interesting in a geognostical point of view, as no map has yet made known the mountainous ramifications which the paramos of Niquitao and Las Rosas send out towards the north-east. Between Tocuyo, Araure, and Barquilimeto, rises the group of the Altar Mountains, connected on the south-east with the paramo of Las Rosas. A branch of the Altar stretches north-east by San Felipe el Fuerte, joining the granitic mountains of the coast near Porto Cabello. The other branch takes an eastward direction towards Nirgua and Tinaco, and joins the chain of the interior, that of Yusma, Villa de Cura, and Sabana de Ocumare.

The region we have been here describing separates the waters which flow to the Orinoco from those which run into the immense lake of Maracaybo and the Caribbean Sea. It includes climates which may be termed temperate rather than hot; and it is looked upon in the country, notwithstanding the distance of more than a hundred leagues, as a prolongation of the metalliferous soil of Pamplona. It was in the group of the western mountains of Venezuela, that the Spaniards, in the year 1551, worked the gold mine of Buria,* which was the origin of the foundation of the town of Barquisimeto.t But these works, like many other mines successively opened, were soon abandoned. Here, as in all the mountains of Venezuela, the produce of the ore has been found to be very variable. The lodes are very often divided, or they altogether cease; and the metals appear only in kidney-ores, and present the most delusive appearances. It is, however, only in this group of mountains of San Felipe and Barquisimeto, that the working of mines has been continued till the present time. Those of Aroa, near San Felipe el Fuerte, situated in the centre of a very insalubrious country, are the only mines which are wrought in the whole capitania-general of Caracas. They yield a small quantity of copper.

[^155]Next to the works at Buria, near Barquisimeto, those of the valloy of Caraoas, and of the mountains near the capital, ane the most ancient. Francisco Faxardo and his wife Isabella, of the nation af the Guaiquerias, " often visited the table-land where the capital of Venezuela is now situated. They had given this table-land the name of Valle do San Francisco; and having seen some bits of gold in the hands of the natives, Faxardo succeeded, in the year 1560, in diseovering the mines of Los Teques, $t$ to the south-west of Caracas, near the group of the mountains of Coouiza, which separate the valleys of Caracas and Aragua It is thought that in the first of these valleys, near Baruta, south of the village of Valle, the natives had made some excavations in veins of auriferous quartz; and that, when the Spaniards first settled there, and founded the town of Caracas, they filled the shafts, which had been dry, with water. It is now impossible to ascortain this fact; but it is certain that, long before the Conquest, grains of gold were a medium of exchange, I do not say generally, but among certain nations of the New Continent. They gave gold for the purchase of pearls; and it does not appear extraordinary, that, after having for a long time picked up grains of gold in the rivulets, people who had fixed habitstions, and were devoted to agriculture, should have tried to trace the auriferous veins in the superior surface of the soil. The mines of Los Teques could not be peaceably wrought, till the defeat of the Cacique Guaycaypuro, a celebrated chief of the Teques, who long contested with the Spaniards the possession of the province of Venezuela.

We have yet to mention a third point to which the attention of the Conquistadores was called by indications

Faxardo and his wife wore the foundere of the town of the Collade, now called Caravalleda.

+ Thirteen years later, in 1573, Gabrick de Avila, one of the alcalder of the new town of Caracas, renewed the working of these mines, which were from that time called the "Real de Minas de Nuestra Sefiora." Probably this same Avila, on account of a few farms which he possessed in the mountains adjacent to La Guayra and Caracas, has occasioned the Cumbre to receive the name of Montaña de Avila. This name has subsequently been applied erroncously to the Silla, and to all the chain which extends towards cape Codera.
of mines, se early as the end of the sixteenth century. In following the valloy of Caraoas eastward beyond Caurimare, on the road to Caucagus, we reach a mountainous and woody country, where a great quantity of charcoal is now made, and which anciently bore the name of the Province of Los Mariches. In these eastern mountains of Venezuela, the gneise passes into the state of talc. It contains, as at Salzburg, lodes of auriferous quartz. The worke anciently began in those mines have often been abandoned and resumed.

The mines of Caracas were forgotten during more than a hundred years. But at a period comparatively reoent, about the end of the last century, an Intendant of Venezuela, Don Jose Avalo, again fell into the illusions. which had flattered the cupidity of the Conquistadores. He fancied that all the mountains near the capital contained great metallic riches. Some Mexican miners were engaged, and their operations were directed to the ravine of Tipe, and the ancient mines of Baruta to the south of Caracas, where the Indians gather even now some little gold-washings. But the zeal which had prompted the enterprise soon diminished, and after much useless expense, the working of the mines of Caracas was totally abandoned. A small quantity of auriferous pyrites, sulphuretted silver, and a little native gold, were found; but these were only feeble indications; and in a country where labour is extremely dear, there was no inducement to pursue works so little productive.

We visited the ravine of Tipe, situated in that part of the valley which opens in the direction of Cabo Blanco. Proveeding from Caracas, we traverse, in the direction of the great barracks of San Carlos, a barren and rooky soil. Only a very few plants of Argemone mexicana are to be found. The gneiss appears everywhere above ground. We might have fancied ourselves on the table-land of Freiberg. We crossed first the little rivulet of Agua Salud, a limpid stream, which has no mineral taste, and then the Rio Garaguata. The road is commanded on the right by the Cerro de Avila and the Cumbre; and an thie left, by the mountains of Aguas Negras. This defile is very interesting in a gealogical point of view. At this spot the valley of Canmenic commu-
nicates, by the valleys of Tacagua and of Tipe, with the coast near Catia. A ridge of rock, the summit of which is forty toises above the bottom of the valley of Caracas, and more than three hundred toises above the valley of Tacagus, divides the waters which flow into the Rio Guayra and towards Cabo Blanco. On this point of division, at the entrance of the branch, the view is highly pleasing. The climate changes as we descend westward. In the vallej of Tacagua we found some new habitations, and also conuco of maize and plantains. A very extensive plantation of tuna, or cactus, stamps this barren country with a peculiar character. The cactuses reach the height of fifteen feet, and grow in the form of candelabra, like the euphorbia of Africa. They are cultivated for the purpose of selling their refreshing fruits in the market of Caracas. The variety which has no thorns is called, strangely enough, in the colonies, tuna de España (Spanish cactus). We measured, at the same place, magueys or agaves, the long stems of which, laden with flowers, were forty-four feet high. However common this plant is become in the south of Europe, the native of a northern climate is never weary of admiring the rapid development of a liliaceous plant, which contains at once a sweet juice and astringent and caustic liquids, employed to cauterize wounds.

We found several veins of quartz in the valley of Tipe visible above the soil. They contained pyrites, carbonated iron-ore, traces of sulphuretted silver (glasserz), and grey copper-ore (fahlerz). The works which had been undertaken, either for extracting the ore, or exploring the nature of its bed, appeared to be very superficial. The earth falling in had filled up those excarations, and we could not judge of the richness of the lobe. Notwithstanding the expense incurred under the intendancy of Don Jose Avalo, the great question whether the province of Venezuela contains mines rich enough to be worked, is yet problematical Though in countries where hands are wanting, the culture of the soil demands unquestionably the first care of the government, yet the example of New Spain suffciently proves that mining is not always unfavourable to the progress of agriculture. The best-cultivated Merican
lands, those which remind the traveller of the most beautiful districts of France and the south of Germany, extend from Silao towards the Villa of Leon: they are in the neighbourhood of the mines of Guanaxuato, which alone furnish a sixth part of all the silver of the New World.

## Chapter XIV:

Earthquakes at Caracas.-Connection of those Phenomena with the Volcanic Eruptions of the West India Islands.

On the evening of the 7th of February we took our departure from Caracas. Since the period of our visit to that place, tremendous earthquakes have changed the surface of the soil. The city, which I have described, has disappeared; and on the same spot, on the ground fissured in various directions, another city is now slowly rising. The heaps of ruins, which were the grave of a numerous population, are becoming anew the habitation of men. In retracing changes of so general an interest, I shall be led to notice events which took place long after my return to Europe. I shall pass over in silence the popular commotions which have taken place, and the modifications which society has undergone. Modern nations, careful of their own remembrances, snatch from oblivion the history of human revolutions, which is, in fact, the history of ardent passions and inveterate hatred. It is not the same with respect to the revolutions of the physical world. These are described with least accuracy when they happen to be contemporary with civil dissensions. Earthquakes and eruptions of volcanos strike the imagination by the evils which are their necessary consequence. Tradition seizes on whatever is vague and marvellous; and amid great public calamities, as in private misfortunes, man seems to shun that light which leads us to discover the real causes of events, and to understand the circumstances by which they are attended.

I have recorded in this work all I have been able to
collect, and on the ecouracy of which I can rely, respecting the earthquake of the 26th of March, 1812. By that catar trophe the town of Caracas was destroyed, and more than twenty thousand persons perished throughout the extent of the province of Venezuela. The intercourse which I hare kept up with persons of all classes has enabled me to compare the description given by many eye-witnesses, and to interrogate them on objects that may throw light on physical science in general. The traveller, as the historian of nature, should verify the dates of great catastrophes, examine their connection and their mutual relations, and should mark in the rapid course of ages, in the continual progress of successive changes, those fixed points with which other catastrophes may one day be compared. All epochs are proximate to each other in the immensity of time comprehended in the history of nature. Years which have passed amay seem but a few instants; and the physical descriptions of a country, even when they offer subjects of no very powerfal and general interest, have at least the advantage of never becoming old. Similar considerations, no doubt, led M. de la Condamine to describe in his Voyage à l'Equateur, the memorable eruptions of the volcano of Cotopaxi, * which took place long after his departure from Quito. I feel the less hesitation in following the example of that celebrated traveller, as the events I am about to relate will help to elucidate the theory of volcanic reaction, or the influence of a system of volcanos on a wast apace of circumjacent territory.

At the time when M. Bonpland and myself visited the provinces of New Andalusia, New Barcelona, and Caracas, it was genorally believed that the most eastern parts of those coasts were especially exposed to the destructive effects of earthquakes. The inhabitants of Cumana dreaded the valley of Caracas, on account of its damp and variable climate, and its gloomy and misty sky; whilst the inhabitants of the temperate valley regarded Cumana as a town whose inhabitants incessantly inhaled a burning atmosphere, and whose soil was periodically agitated by violent commotions. Unmindful of the overthrow of Riobamba and other very

* Those of the 30th of November, 1744, and of the 3rd of Sap. tember, 1750.
elevated towns, and not aware that the peninsula of Araya, composed of mica-slate, shares the commotions of the calcareous coast of Cumana, well-informed persons imagined they discerned security in the structure of the primitive rocks of Caracas, as well as in the elevated situation of this valley. Religious ceremonies celebrated at La Guayra, and even in the capital, in the middle of the night,* doubtless called to mind the fact that the province of Venezuela had been subject at intervals to earthquakes; but dangers of rare occurrence are slightly feared. Hawever, in the year 1811, fatal experience destroyed the illusion of theory and of popular apinion. Caracas, situated in the mountains, three degrees west of Cumana, and five degrees west of the volcanos of the Caribbee islands, has suffered greater shocks than were ever experienced on the coast of Paria or New Andalusia.

At my arrival in Teria Firma, I was struck with the connection between the destruction of Cumana on the 14th of December, 1797, and the eruption of the volcanos in the smaller West India Islands. This connection was again manifest in the destruction of Caracas on the 26th of March, 1812. The volcano of Guadalaupe seemed in 1797 to have exercised a reaction on the coasts of Cumana. Ffteen years later, it was a volcano situated nearer the continent (that of St. Vincent), which appeared to have extended its influence as far as Caracas and the banks of Apure. Possibly, at both those periods, the centre of the explosion was, at an immense depth, equally distant from the regions towards which the motion was propagated at the surface of the globe.

From the beginning of $\mathbf{1 8 1 1}$ to 1813 , a vast superficies of the earth, $\dagger$ bound by the meridian of the Azores, the valley of the Ohio, the Cordilleras of New Grensda, the coasts of Venezuela, and the volcanos of the smaller West India Islands, was shaken throughout its whole extent, by com-

[^156]motions which may be attributed to subterranean fires. The following series of phenomens seems to indicate communications at enormous distances. On the 30th of January, 1811, a submarine volcano broke out near the island of St. Michael, one of the Azores. At a place where the sea was sixty fathoms deep, a rock made its appearance above the surface of the waters. The heaving-up of the softened crust of the globe appears to have preceded the eruption of flame at the crater, as had already been observed at the volcanos of Jorullo in Mexico, and on the appearance of the little island of Kameni, near Santorino. The nem islet of the Azores was at first a mere shoal; but on the 15th of June, an eruption, which lasted six days, enlarged its extent, and carried it progressively to the height of fifty toises above the surface of the sea. This new land, of which captain Tillard took possession in the name of the British government, giving it the name of Sabrina Island, was nine hundred toises in diameter. It has again, it seems, been swallowed up by the ocean. This is the third time thast submarine volcanos have presented this extraordinary spectacle near the island of St. Michael; and, as if the erupticns of these volcanos were subject to periodical recurrence, owing to a certain accumulation of elastic fluids, the island raised up has appeared at intervals of ninety-one or ninety: two years.*

At the time of the appearance of the new island of Sabrina, the smaller West India Islands, situated eight hundred leagues south-west of the Azores, experienced frequent earthquakes. More than two hundred shocks were felt from the month of May 1811, to April 1812, at St. Vincent; one of the three islands in which there are still active volcanos. The commotion was not circumscribed to the insular portion of eastern America; and from the 16th of December, 1811, till the year 1813, the earth was almost incessantly agitated in the valleys of the Mississippi,

[^157]the Arkansas river, and the Ohio. The oscillations were more feeble on the east of the Alleghanies, than to the west of these mountains, in Tennessee and Kentucky. They were accompanied by a great subterranean noise, proceeding from the south-west. In some places between New Madrid and Little Prairie, as at the Saline, north of Cincinnati, in latitude $37^{\circ} 45^{\prime}$, shocks were felt every day, nay almost every hour, during several months. The whole of these phenomena continued from the 16th of December 1811, till the year 1813. The commotion, confined at first to the south, in the valley of the lower Mississippi, appeared to advance slowly northward.

Precisely at the period when this long series of earthquakes commenced in the Transalleghanian States (in the month of December 1811), the town of Caracas felt the first shock in calm and serene weather. This coincidence of phenomena was probably not accidental; for it must be borne in mind that, notwithstanding the distance which separates these countries, the low grounds of Louisiana and the coasts of Venezuela and Cumana belong to the same basin, that of the Gulf of Mexico. When we consider geologically the basin of the Caribbean Sea, and of the Gulf of Mexico, we find it bounded on the south by the coast-chain of Venezuela and the Cordilleras of Merida and Pamplona; on the east by the mountains of the West Iudia Islands, and the Alleghanies; on the west by the Andes of Mexico, and the Rocky Mountains; and on the north by the very inconsiderable elevations which separate the Canadian lakes from the rivers which flow into the Mississippi. More than two-thirds of this basin are covered with water. It is bordered by two ranges of active volcanos; on the east, in the Carribee Islands, between latitudes $13^{\circ}$ and $16^{\circ} ;$ and on the west in the Cordilleras of Nicaragua, Guatimala, and Mexico, between latitudes $11^{\circ}$ and $20^{\circ}$. When we reflect .that the great earthquake at Lisbon, of the 1st of November, 1755 , was felt almost simultaneously on the coasts of Sweden, at lake Ontario, and at the island of Martinique, it may not seem unreasonable to suppose, that all this basin of the West Indies, from Cumana and Caracas as far as the plains of Louisiana, should be simultaneously agitated by commotions proceeding from the same centre of action.

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It is an opinion very generally prevalent on the coasts of Terra Firma, that earthquakes become more frequent when electric explosions have been during some years rare. It is supposed to have been observed, at Cumana and at Caracas, that the rains were less frequently attended with thunder from the year 1792; and the total destruction of Cumana in 1797, as well as the commotions felt in 1800, 1801, and 1802, at Maracaibo, Porto Cabello, and Caracas, have not failed to be attributed to an accumulation of electricity in the interior of the earth. Persons who hare lived long in New Andalusia, or in the low regions of Pern, will admit that the period most to be dreaded for the frequency of earthquakes is the beginning of the rainy season, which, however, is also the season of thunder-storms. The atmosphere and the state of the surface of the globe seem to exercise an influence unknown to us on the changes which take place at great depths; and I am inclined to think that the connection which it is supposed has been traced between the absence of thunder-storms and the frequency of earthquakes, is rather a physical hypothesis framed by the half-learned of the country than the result of long experience. The coincidence of certain phenomens may be favoured by chance. The extraordinary commotions felt almost continually during the space of two years on the banks of the Mississippi and the Ohio, and which corresponded in 1812 with those of the valley of Caracas, were preceded at Louisiana by a year almost exempt from thun-der-storms. The public mind was again struck with this phenomenon. We cannot be surprised that there should be in the native land of Franklin a great readiness to receire explanations founded on the theory of electricity.

The shock felt at Caracas in the month of December 1811, was the only one which preceded the terrible catastrophe of the 26th of March, 1812. The inhabitante of Terra Firma were alike ignorant of the agitations of the volcano in the island of St. Vincent, and of those felt in the basin of the Mississippi, where, on the 7 th and 8th of February, 1812, the earth was day and night in perpetual oscillation. A great drought prevailed at this period in the province of Venezuela. Not a single drop of rain had fallen at Caracas or in the country to the distance of ninetr
leagues round, during five months preceding the destruction of the capital. The 26 th of March was a vemarkably hot day. The air was calm, and the sky unclouded. It was Ascension-day, and a great portion of the population was assembled in the churches. Nothing seemed to presage the calamities of the day. At seven minutes after four in the afternoon the first shock was felt. It was sufficiently forcible to make the bells of the churches toll; and it lasted five or six seconds. During that interval the ground was in a continual undulating movement, and seemed to heave up like a boiling liquid. The danger was thought to be past, when a tremendous subterranean noise was heard, resembling the rolling of thunder, but louder and of longer continuance than that heard within the tropics in the time of storms. This noise preceded a perpendicular motion of three or four seconds, followed by an undulatory movement somewhat longer. The shocks were in opposite directions, proceeding from north to south, and from east to west. Nothing could resist the perpendicular movement and the transverse undulations. The town of Caracas was entirely overthrown, and between nine and ten thousand of the inhabitants were buried under the ruins of the houses and churches. The procession of Ascension-day had not yet begun to pass through the streets, but the crowd was so great within the churches that nearly three or four thousand persons were crushed by the fall of the roofs. The explosion was most violent towards the north, in that part of the town situated nearest the mountain of Avila and the Silla. The churches of la Trinidad and Alta Gracia, which were more than one hundred and fifty feet high, and the naves of which were supported by pillars of twelve or fifteen feet diameter, were reduced to a mass of ruins scarcely exceeding five or six feet in elevation. The sinking of the ruins has been so considerable that there now scarcely remain any vestiges of pillars or columns. The barracks, called el Quartel de San Carlos, situated north of the church of la Trinidad, on the road from the custom-house of La Pastora, almost entirely disappeared. A regiment of troops of the line, under arms, and in readiness to join the procession, was, with the exception of a few men, *buried beneath the ruins of the barracks. Nine-tenths of the fine city of 2 G 2

Caracas were entirely destroyed. The walls of some houses not thrown down, as those in the street San Juan, near the Capuchin Hospital, were cracked in such a manner as to render them uninhabitable. The effects of the earthquake were somewhat less violent in the western and southern parts of the city, between the principal square and the ravine of Caraguata. There, the cathedral, supported by enormous buttresses, remains standing -

It is computed that nine or ten thousand persons were killed in the city of Caracas, exclusive of those who, being dangerously wounded, perished several months after, for want of food and proper care. The night of the Festival of the Ascension witnessed an awful scene of desolation and distress. The thick cloud of dust which, rising above the ruins, darkened the sky like a fog, had settled on the ground. No commotion was felt, and never was a night more calm or more serene. The moon, then nearly at the full, illumined the rounded domes of the Silla, and the aspect of the sky formed a perfect contrast to that of the earth, which was covered with the bodies of the dead, and heaped with ruins. Mothers were seen bearing in their arms their children, whom they hoped to recall to life. Desolate families were wandering through the city, seeking a brother, a husband, or a friend, of whose fate they were ignorant, and whom they believed to be lost in the crowd. The people pressed along the streets, which could be traced only by long lines of ruins.

All the calamities experienced in the great catastrophes of Lisbon, Messina, Lima, and Riobamba were renewed at Caracas on the fatal 26th of March, 1812. Wounded persons, buried beneath the ruins, were heard imploring by their cries the help of the passers-by, and nearly two thousand were dug out. Never was pity more tenderly evinced; never was it more ingeniously active than in the efforts employed to save the miserable victims whose groans reached the ear. Implements for digging and clearing away the ruins were entirely wanting; and the people were obliged to use their bare hands, to disinter the living. The wounded, as well as the invalids who had escaped from the hospitals, were laid on the banks of the small river Guayra, where there was no shelter but the foliage of trees. Beds, linen to dress the
wounds, instruments of surgery, medicines, every object of - the most urgent necessity, was buried in the ruins. Everything, even food, was wanting; and for the space of several days water became scarce in the interior of the city. The commotion had rent the pipes of the fountains; and the falling in of the earth had choaked up the springs that supplied them. To procure water it was necessary to go down to the river Guayra, which was considerably swelled; and even when the water was obtained vessels for conveying it were wanting.

There was a duty to be fulfilled to the dead, enjoined at once by piety and the dread of infection. It being impossible to inter so many thousand bodies, half-buried under the ruins, commissioners were appointed to burn them: and for this purpose funeral piles were erected between the heaps of ruins. This ceremony lasted several days. Amidst so many public calamities, the people devoted themselves to those religious duties which they thought best fitted to appease the wrath of heaven. Some, assembling in processions, sang funeral hymns; others, in a state of distraction, made their confessions aloud in the streets. In Caracas was then repeated what had been remarked in the province of Quito, after the tremendous earthquake of 1797; a number of marriages were contracted between persons who had neglected for many years to sanction their union by the sacerdotal benediction. Children found parents, by whom they had never till then been acknowledged; restitutions were promised by persons who had never been accused of fraud; and families who had long been at enmity were drawn together by the tie of common calamity. But if this feeling seemed to calm the passions of some, and open the heart to pity, it had a contrary effect on others, rendering them more rigorous and inhuman. In great calamities rulgar minds evince less of goodness than of energy. Misfortune acts in the same manner as the pursuits of literature and the study of nature; the happy influence of which is felt only by a few, giving more ardour to sentiment, more elevation to the thoughts, and increased benevolence to the disposition.

Shocks as violent as those which in about the space of a
minute *, overthrew the city of Caracas, could not be confined to a small portion of the contineut. Their fatal effects. extended as far as the provinces of Venezuela, Varinas, and Maracaibo, along the coast; and especially to the inland mountains. La Guayra, Mayquetia, Antimano, Baruta, La Vega, San Felipe, and Merida, were almost entirely dostroyed. The number of the dead exceeded four or five thousand at La Guayra, and at the town of San Felipe, near the copper-mines of Aroa. It would appear that on a line running E.N.E. and W.S.W. from La Guayra and Caracas to the lofty mountains of Niquitao and Merida, the violence of the carthquake was principally directed. It was felt in the kingdom of New Grenada from the branches of the high Sierra de Santa Marthat as far as Santa Fé de Bogotá and Honda, on the banks of the Magdalena, one hundred and eighty leagnes from Caracas. It was everywhere more violent in the Cordilleras of gneiss and mica-slate, or immediately at their base, than in the plains; and this difference was particularly striking in the savannahs of Varinas and Casanara. $\ddagger$ In the valleys of Aragua, between Caracas and the town of San Felipe, the commotions were very slight; and La Victoria, Maraoay, and Valencia, scarcely suffered at all, notwithstanding their proximity to the capital. At Valecillo, a few leagues from Valencia, the yawning earth threw out such an immense quantity of water, that it formed a new torrent. The same phenomenon took place near Porto-Cabello.§ On the other hand, the lake of Maracaibo diminished sensibly. At Coro no commotion was felt, though the town is situated on the coast, between other towns which suffered from the earthquake. Fishermen, who

[^159]had passed the day of the 26th of March in the island of Orchila, thirty leagues north-east of La Guayra, felt no shock. These differences in the direction and propagation of the shock, are probably owing to the peculiar position of the stony strata.

Having thus traced the effects of the earthquake to the west of Caracas, as far as the snowy mountains of Santa Martha, and the table-land of Santa Fé de Bogotá, we will proceed to consider their action on the country eastward of the capital. The commotions were very violent beyond Caurimare, in the valley of Capaya, where they extended as far as the meridian of Cape Codera: but it is extremely remarkable that they were very feeble on the coasts of Nueva Barcelona, Cumana, and Paria; though these coasts are the continuation of the shore of La Guayra, and were formerly known to have been often agitated by subterranean commotions. Admitting that the destruction of the four towns of Caracas, La Guayra, San Felipe, and Merida, may be attributed to a volcanic focus situated under or near the island of St. Vincent, we may conceive that the motion might have been propagated from north-east to south-west in a line passing through the islands of Los Hermanos, near Blanquilla, without touching the coasts of Araya, Cumana, and Nueva Barcelona. This propagation of the shock might even have taken place without any commotion having been felt at the intermediate points on the surface of the globe (the Hermanos Islands for instance). This phenomenon is frequently remarked at Peru and Mexico, in earthquakes which have followed during ages a fixed direction. The inhabitants of the Andes say, speaking of an intermediary tract of ground, not affected by the general commotion, " that it forms a bridge" (que hace puente): as if they mean to indicate by this expression that the undulations are propagated at an immense depth under an inert rock.

At Caracas, fifteen or eighteen hours after the great catastrophe, the earth was tranquil. The night, as has already been observed, was fine and calm; and the commotions did not recommence till after the 27 th. They were then attended by a very loud and long continued subterranean noise (bramido). The inhabitants of the destroyed city wandered into the country; but the villages and farms
having suffered as much as the town, they could find no shelter till they were beyond the mountains of los Teques, in the valleys of Aragua, and in the llanos or savannabs. No less than fifteen oscillations were felt in one day. On the 5th of April there was almost as violent an earthquake as that which overthrew the capital. During several hours the ground was in a state of perpetual undulation. Large heaps of earth fell in the mountains; and enormous masses of rock were detached from the Silla of Caracas. It was even asserted, and this opinion prevails still in the country, that the two domes of the Silla sunk fifty or sixty toises; but this statement is not founded on any measurement. I am informed that, in like manner, in the province of Quito, the people, at every period of great commotions, imagine that the volcano of Tunguragua diminishes in height. It has been affirmed, in many published accounts of the destruction of Caracas, that the mountain of the Silla is an extinguished volcano; that a great quantity of volcanic substances are found on the road from La Guayra to Caracas; that the rocks do not present any regular stratification; and that everything bears the stamp of the action of fire. It has even been stated that twelve years prior to the great catastrophe, M. Bonpland and myself had, from our own observations, considered the Silla as a very dangerous neighbour to the city of Caracas, because the mountain contained a great quantity of sulphur, and the commotions must come from the north-east. It is seldom that observers of nature have to justify themselves for an accomplished prediction; but I think it my duty to oppose ideas which are too easily adopted on the local causes of earthquakes.

In all places where the soil has been incessantly agitated for whole months, as at Jamaica in 1693, Lisbon in 1755, Cumana in 1766, and Piedmont in 1808, a volcano is expected to open. People forget that we must seek the focus or centre of action, far from the surface of the earth; that, acc ording to undeniable evidence, the undulations are propagated almost at the same instant across seas of immense depth, at the distance of a thousand leagues; and that the greatest commotions take place not at the foot of active volcanos, but in chains of mountains composed of the most heterogeneous rocks. In our geognostical observation of
the country round Caracas we found gneiss, and mica-slate containing beds of primitive limestone. The strata are scarcely more fractured or irregularly inclined than near Freyburg in Saxony, or wherever mountains of primitive formation rise abruptly to great heights. I found at Caracas neither basalt nor dorolite, nor even trachytes or trap-porphyries; nor in general any trace of an extinguished volcano, unless we choose to regard the diabases of primitive grünstein, contained in gneiss, as masses of lava, which have filled up fissures. These diabases are the same as those of Bohemia, Saxony, and Franconia;* and whatever opinion may be entertained respecting the ancient causes of the oxidation of the globe at its surface, all those primitive mountains, which contain a mixture of hornblende and feldspar, either in veins or in balls with concentric layers, will not, I presume, be called volcanic formations. Mont Blanc and Mont d'Or will not be ranged in one and the same class. Even the partisans of the Huttonian or volcanic theory make a distinction between the lavas melted under the mere pressure of the atmosphere at the surface of the globe, and those layers formed by fire beneath the immense weight of the ocean and superincumbent rocks. They would not confound Auvergne and the granitic valley of Caracas in the same denomination; that of a country of extinct volcanos.

I never could have pronounced the opinion, that the Silla and the Cerro de Avila, mountains of gneiss and mica-slate, were in dangerous proximity to the city of Caracas because they contained a great quantity of pyrites in subordinate beds of primitive limestone. But I remember having said, during my stay at Caracas, that the eastern extremity of Terra Firma appeared, since the great earthquake of Quito, in a state of agitation, which warranted apprehension that the province of Venezuela would gradually be exposed to violent commotions. I added, that when a country had been long subject to frequent shocks, new subterranean communications seemed to open with neighbouring countries; and that the volcanos of the West India Islands,

[^160]lying in the direction of the Silla, north-east of the city, were perhaps the vents, at the time of an eruption, for those elastic fluids whlch cause earthquakes on the coasts of the continent. These considerations, founded on local knowledge of the place, and on simple analogies, are very fur from a prediction justified by the course of physical events.

On the 30th of April, 1812, whilst violent commotions were felt simultaneously in the valley of the Mississippi, in the island of St. Vincent, and in the province of Venezuela, $a$ subterranean noise resembling frequent discharges of large cannon was heard at Caracas, at Calabozo (situated in the midst of the steppes), and on the borders of the Rio Apure, over a superficies of four thousand square leagues. This noise began at two in the morning. It was accompanied by no shock; and it is very remarkable, that it was as loud on the coast as at the distance of eighty leagues inland. It was everywhere believed to be transmitted through the air; and was so far from being thought a subterranean noise, that in several places, preparations were made for defence against an enemy, who seemed to be advancing with heavy artillery. Señor Palacio, crossing the Rio Apure below the Orivante, near the junction of the Rio Nula, was told by the inhabitants, that the firing of cannon had been heard distinctly at the western extremity of the province of Varinas, as well as at the port of La Guayra to the north of the chain of the coast.

The day on which the inhabitants of Terra Firma were alarmed by a subterranean noise was that of the great eruption of the volcano in the island of St. Vincent. That mountain, near five hundred toises high, had not thrown out lava since the year 1718. Scarcely was any smoke perceived to issue from it, when, in the month of May 1811, frequent shocks announced that the volcanic fire was either rekindled, or directed anew to that part of the West Indies. The first eruption did not take place till the 27th of April, 1812, at noon. It was merely an ejection of ashes, but attended with a tremendous noise. On the 30th, the lava overflowed the brink of the crater, and, after a course of four hours, reached the sea. The sound of the explosion is described as resembling that of alternate discharges of very large cannon and musketry; and it is worthy of no-
mark, that it seemed much louder to persons out at sea, and at a great distance from land, than to those within sight of land, and near the burning volcano.

The distance in a straight line from the volcano of St. Vincent to the Rio Apure, near the mouth of the Nula, is two hundred and ten leagues.* The explosions were consequently heard at a distance equal to that between Vesuvius and Paris. This phenomenon, in conjunction with a great number of facts observed in the Cordilleras of the Andes, shows that the sphere of the subterranean activity of a volcano is much more extensive than we should be disposed to admit, if we judged merely from the small changes effected at the surface of the globe. The detonations heard during whole days together in the New World, eighty, one hundred, or even two hundred leagues distant from a crater, do not reach us by the propagation of the sound through the air; they are transmitted by the earth, perhaps in the very place where we happen to be. If the eruptions of the valcano of St. Vincent, Cotopaxi, or Tunguragua, resounded from afar, like a cannon of immense magnitude, the noise ought to increase in the inverse ratio of the distance : but observations prove, that this augmentation does not take place. I must further observe, that M. Bonpland and I, going from Guayaquil to the coast of Mexico, crossed latitudes in the Pacific, where the crew of our ship were dismayed by a hollow sound coming from the depth of the ocean, and transmitted by the waters. At that time a new eruption of Cotopaxi took place, but we were as far distant from the volcano, as Etna from the city of Naples. The little town of Honda, on the banks of the Magdalena, is not less than one hundred and forty-five leaguest from Cotopaxi; and yet, in the great explosions of this volcano, in 1744, a subterranean noise was heard at Honda, and supposed to be discharges of heavy artillery. The monks of San Francisco spread a report that the town of Carthagena was besieged and bombarded by the English; and the intelligence was believed throughout the country. Now

[^161]the volcano of Cotopaxi is a cone, more than one thousand eight hundred toises above the basin of Honda, and is rises from a table-land, the elevation of which is more than one thousand five hundred toises above the valley of the Magdalena. In all the colossal mountains of Quito, of the province of los Pastos, and of Popayan, crevices and rad. leys without number intervene. It cannot be admitted, under these circumstances, that the noise was transmitted through the air, or over the surface of the globe, and that it came from the point at which the cone and crater of Cotapaxi are situated. It appears probable, that the more elevated part of the kingdom of Quito and the neighbouring Cordilleras, far from being a group of distinct volcanoes, constitute a single swollen mass, an enormous rot canic wall, stretching from south to north, and the crest of which presents a superficies of more than six hundred square leagues. Cotopaxi, Tunguragua, Antisana, and Pichincha, are on this same raised ground. They have different names, but they are merely separate summits of the same volcanic mass. The fire issues sometimes from one, sometimes from another of these summits. The obstructed craters appear to be extinguished volcanos; but we maj presume, that, while Cotopaxi or Tunguragua have only one or two eruptions in the course of a century, the fire is not less continually active under the town of Quito, under Pichincha and Imbabura.

Advancing northward we find, between the volcano of Cotopaxi and the town of Honda, two other systems of volcanic mountains, those of los Pastos and of Poparan. The connection between these systems was manifested in the Andes by a phenomenon which I have already had occasion to notice, in speaking of the last destruction of Cumanta. In the month of November 1796 a thick column of smoke began to issue from the volcano of Pasto, west of the town of that name, and near the valley of Rio Guaytara The mouths of the volcano are lateral, and situated on its western declivity, yet during three successive months the column of smoke rose so much higher than the ridge of the mountain that it was constantly visible to the inhabitants of the town of Pasto. They desoribed to us their astonishment when, on the 4th of February, 1797, they observed the
smoke disappear in an instant, whilst no shock whatever was felt. At that very moment, sixty-five leagues southward, between Chimborazo, Tunguragua, and the Altar (Capac-Urcu), the town of Riobamba was overthrown by the most terrible earthquake on record. Is it possible to doubt, from this coincidence of phenomeña, that the vapours issuing from the small apertures or ventanillas of the volcano of Pasto had an influence on the pressure of those elastic fluids which convulsed the earth in the kingdom of Quito, and destroyed in a few minutes thirty or forty thousand inhabitants?

To explain these great effects of volcanic reactions, and to prove that the group or system of the volcanos of the West India Islands may sometimes shake the continent, I have cited the Cordillera of the Andes. Geological reasoning can be supported only by the analogy of facts which are recent, and consequently well authenticated: and in what other region of the globe could we find greater and more varied volcanic phenomena than in that double chain of mountains heaved up by fire? in that land where nature has covered every mountain and every valley with her marvels? If we consider a burning crater only as an isolated phenomenon, if we be satisfied with merely examining the mass of stony substances which it has thrown up, the volcanic action at the surface of the globe will appear neither very powerful nor very extensive. But the image of this action becomes enlarged in the mind when we study the relations which link together volcanos of the same group; for instance, those of Naples and Sicily, of the Canary Islands,* of the

[^162]Asores, of the Caribbee islands of Mexico, of Guatimath and of the table-land of Quito; when we examine either the reactions of these different systems of volcanos on one noother, or the distance at which, by subterranean commnnication, they simultaneously convulse the earth.

The study of volcanos may be divided into two distinc branches; one, simply mineralogical, is directed to the exsmination of the stony strata, altered or produced by the action of fire; from the formation of the trachytes or tray porphyries, of basalts, phonolites, and dolerites, to the most recent laras: the other branch, less accessible and more neglected, comprehends the physical relations which limb volcanos together, the influence of one volcanic system or another, the connection existing between the action o: burning mountains and the commotions which agitate the earth at great distances, and during long intervals, in the same direction. This study cannot progress till the varions epochs of simultaneous action, the direction, the extent, and the force of the convulsions are carefully noted; till we have attentively observed their progressive advance to regions which they had not previously reached; and the coincidence between distant volcanic eruptions and those noises which the inhabitants of the Andes very expressively term subterraneous thunders, or roarings.* All these objects are comprehended in the domain of the history of nature.

Though the narrow circle within which all certain traditions are confined, does not present any of those general revolutions which have heared up the Cordilleras and buried myriads of pelagian animals; yet Nature, acting under our eyes, nevertheless exhibits violent though partial changes, the study of which may throw light on the most remote epochs. In the interior of the earth those mysterious powers exist, the effects of which are manifested at the surface br the production of vapours, of incandescent scoriæ, of nex volcanic rocks and thermal springs, by the appearance of

Cotopaxi, Tunguragua, Pichincha, Antisana, and Sangai, belong to the same system of burning volcanos; they are generally ranged in rows, as if they had issued from a crevice, or vein not filled up; and, it is ver! remarkable, that their position is in some parts in the general direction of the Cordilleras, and in others in a contrary direction.

* Bramidos y truenos subterraneos.
new islands and mountains, by commotions propagated with the rapidity of an electric shock, finally by those subterranean thunders,* heard during whole months, without shaking the earth, in regions far distant from active volcanos.

In proportion as equinoctial America shall increase in culture and population, and the system of volcanos of the central table-land of Mexico, of the Caribbee Islands, of Popayan, of los Pastos, and Quito, shall be more attentively observed, the connection of eruptions and of earthquakes, which precede and sometimes accompany those eruptions, will be more generally recognized. The volcanos just mentioned, particularly those of the Andes, which rise above the enormous height of two thousand five hundred toises, present great advantages for observation. The periods of their eruptions are singularly regular. They remain thirty or forty years without emitting scorim, ashes, or even vapours. I could not perceive the smallest trace of smoke on the summit of Tunguragus or Cotopaxi. A gust of vapour issuing from the crater of Mount Vesuvius scarcely attracts the attention of the inhabitants of Naples, accustomed to the movements of that little volcano, which throws out scorim sometimes durng two or three years successively. Thence it becomes difficult to judge whether the emission of scorim may have been more frequent at the time when an earthquake has been felt in the Apennines. On the ridge of the Cordilleras everything assumes a more decided character. An eruption of ashes, which lasts only a few minutes, is often followed by a calm of ten years. In such circumstances it is easy to mark the periods, and to observe the coincidence of phenomena.

If, as there appears to be little reason to doubt, that the destruction of Cumana in 1797, and of Caracas in 1812, indi-

[^163]cate the influence of the volcanos of the West India Islands* on the commotions felt on the coasts of Terra Firma, it way be desirable, before we close this chapter, to take a cursory view of this Mediterranean archipelago. The volcanic islands form one-fifth of that great arc extending from the coast of Paria to the peninsula of Florida. Running from south to north, they close the Caribbean Sea on the eastern side, while the greater West India Islands appear like the remains of a group of primitive mountains, the summit of which seems to have been between Cape Abacou, Point Morant, and the Copper Mountains, in that part where the islands of St. Domingo, Cuba, and Jamaica, are nearest to each other. Considering the basin of the Atlantic as an immense valley $\dagger$ which separates the two continents, and where, from $20^{\circ}$ south to $30^{\circ}$ north, the salient angles (Brazil and Senegambia) correspond to the receding angles (the gulf of Guinea and the Caribbean Sea), we are led to think that the latter sea owes its formation to the action of currents, which, like the current of rotation now existing, have flowed from east to west; and have given

* The following is the series of the phenomena :-

27th of September, 1796. Eruption in the West India Islands. (Volcano of Guadaloupe).

November, 1796. The volcano of Pasto began to emit smoke.
14th of December, 1796. Destruction of Cumana.
4th of February, 1797. Destruction of Riobamba.
30th of January, 1811. Appearance of Sabrina Island, in the Azores. The island enlarged very considerably on the 15th of June, 1811.

May, 1811. Commencement of the earthquakes in the island of St. Vincent, which lasted till May 1812.

16th of December, 1811. Commencement of the commotions in the valley of the Mississippi and the Ohio, which lasted till 1813.

December, 1811. Earthquake at Caracas.
26th of March, 1811. Destruction of Caracas. Earthquakes, which continued till 1813.

30th of April, 1811. Eruption of the volcano in St. Vincent; and the same day subterranean noises at Caracas, and on the banks of the Apure.

+ The valley is narrowest ( 300 leagues) between Cape St. Roque and Sierra Leone. Proceeuing toward the north along the coasts of the New Continent, from its pyramidal evtremity, or the Straits of Magellan, we imagine we recognise the effecte of a repulsion directed first toward the north-east, then toward the north-west, and finally again to the northeast.
the southern coast of Porto Rico, St. Domingo, and the island of Cuba their uniform configuration. This supposition of an oceanic irruption has been the source of two other hypotheses on the origin of the smaller West India Islands. Some geologists admit that the uninterrupted chain of islands from Trinidad to Florida exhibits the remains of an ancient chain of mountains. They connect this chain sometimes with the granite of French Guiana, sometimes with the calcareous mountains of Pari. Others, struck with the difference of geological constitution between the primitive mountains of the Greater and the volcanic cones of the Lesser Antilles, consider the latter as having risen from the bottom of the sea.

If we recollect that volcanic upheavings, when they take place through elongated crevices, usually take a straight direction, we shall find it difficult to judge from the disposition of the craters alone, whether the volcanos have belonged to the same chain, or have always been isolated. Supposing an irruption of the ocean to take place either into the eastern part of the island of Java* or into the Cordilleras of Guatemala and Nicaragua, where so many burning mountains form but one chain, that chain would be divided into several islands, and would perfectly resemble the Caribbean Archipelago. The union of primitive formations and volcanic rocks in the same range of mountain is not extraordinary; it is very distinctly seen in my geological sections of the Cordillera of the Andes. The trachytes and basalts of Popayan are separated from the system of the volcanos of Quito by the mica-slates of Almaguer; the volcanos of Quito from the trachytes of Assuay by the gneiss of Condorasta and Guasunto. There does not exist a real chain of mountains running south-east and north-west from Oyapoc to the mouths of the Orinoco, and of which the smaller West India Islands might be a northern prolongation. The granites of Guiana, as well as the hornblende-slates, which I saw near Angostura, on the banks of the Lower Orinoco, belong to the mountains of Pacaraimo and of

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Parime, stretching from west to east,* in the interior of the continent, and not in a direction parallel with the coast, between the mouths of the river Amazon and the Orinoco. But though we find no chain of mountains at the northeast extremity of Terra Firma, having the same direction as the archipelago of the smaller West India Islands, it does not therefore follow that the volcanic mountains of the archipelago may not have belonged originally to the continent, and formed a part of the littoral chain of Caracas and Cumana. $\dagger$

In opposing the objections of some celebrated naturalists, I am far from maintaining the ancient contiguity of all the smaller West India Islands. I am rather inclined to consider them as islands heaved up by fire, and ranged in that regular line, of which we find striking examples in so many volcanic hills in Auvergne, in Mexico, and in Pern. The geological constitution of the Archipelago appears, from the little we know respecting it, to be very similar to that of the Azores and the Canary Islands. Primitive formations are nowhere seen above ground; we find only what belongs unquestionably to volcanos: feldspar-lava, dolerite, basalt, conglomerated scoriæ, tufa, and pumice-stone. Among the limestone formations we must distinguish those which are essentially subordinate to volcanic tufas $\ddagger$ from

- From the cataracts of Atures towards the Essequibo River. This chain of Pacaraimo divides the waters of the Carony from those of the Rio Parime, or Rio de Aguas Blancas.
+ Among many such examples which the structure of the globe displays, we shall mention only the inflexion at a right angle formed by the Higher Alps towards the maritime Alps, in Europe; and the BelowrTagh, which joins transversely the Mouz-Tagh and the Himalaya, in Asia. Amid the prejudices which impede the progress of mineralogical goography, we may reckon, lst, the supposition of a perfect uniformity of direction in the chains of mountains; 2nd, the hypothesis of the continuity of all chains; 3rd, the supposition that the highest summits determine the direction of a central chain; 4th, the idea that, in all places where great rivers take rise, we may suppose the existence of great tablelands, or very high mountains.
$\ddagger$ We have noticed some of the above, following Von Buch, at Lancerote, and at Fortaventura, in the system of the Canary Islands. Among the smaller islands of the West Indies, the following islets are entirels calcaregus, according to M. Cortès: Mariegalante, La Desirade, the Grande Terre of Guadaloupe, and the Grenadillas. According to the observations of that naturalist, Curaçoa and Buenos Ayres present only
those which appear to be the work of madrepores and other zoophytes. The latter, according to M. Moreau de Jonnès, seem to lie on shoals of a volcamic nature. Those mountains, which present traces of the action of fire more or less recent, and some of which reach nearly nine hundred toises of elevation, are all situated on the western skirt of the smaller West India Islands.* Each island is not the effect of one single heaving-up: most of them appear to consist of isolated masses which have been progressively united together. The matter has not been emitted from one crater, but from several; so that a single island of small extent contains a whole system of volcanos, regions purely basaltic, and others covered with recent lavas. The volcanos still burning are those of St. Vincent, St. Lucia, and Guadaloupe. The first threw out lava in 1718 and 1812; in the second there is a continual formation of sulphur by the condensation of vapours, which issue from the crevices of an ancient crater. The last eruption of the volcano of Guadaloupe took place in 1797. The Solfatara of St. Christopher's was still burning in 1692. At Martinique, Vauclin, Montagne Pelée, and the crater surrounded by the five Paps of Carbet, must be considered as three extinguished volcanos. The effects of thunder have been often confounded in that place with subterranean fire. No good observation has confirmed the supposed eruption of the 22nd of January,
calcareous formations. M. Cortès divides the West India Islands into, 1st, those containing at once primitive, secondary, and volcanic formations, like the greater islands; 2nd, those entirely calcareous, (or at least so considered) as Mariegalante and Curaçoa; 3rd, those at once volcanic and calcareous, as Antigua, St. Bartholomew, St. Martin, and St. Thomas ; 4th, those which have volcanic rocks only, as St. Vincent, St. Lucia, and St. Eustache.
* Journal des Mines, tom. iii. p. 59. In order to exhibit in one point of view the whole system of the volcanos of the smaller West India Islands, I will here trace the direction of the islands from south to north.-Grenada, an ancient crater, filled with water; boiling springs; basalts between St. George and Goave.-St. Vincent, a burning volcano. -St. Lucia, a very active solfatara, named Oualibou, two or three hundred toises high; jets of hot water, by which small basins are periodically filled.-Martinique, three great extinguished volcanos; Vauclin, the Paps of Carbet, which are perhaps the most elevated summits of the smaller islands, and Montagne Pelée. (The height of this last mountain is probably 800 toises; according to Leblond it is 670 toises; according

1792. The group of volcanos in the Caribbee Islands resembles that of the volcanos of Quito and Los Pastos; craters with which the subterranean fire does not appear to communicate are ranged on the same line with burning craters, and alternate with them.

Notwithstanding the intimate connection manifested in the action of the volcanos of the smaller West India Islands and the earthquakes of Terra Firma, it often happens that shocks felt in the volcanic archipelago are not propagated to the island of Trinidad, or to the coasts of Caracas and Cumana. This phenomenon is in no way surprising : even in the Caribbees the commotions are often confined to one place. The great eruption of the volcano in St. Vincent's did not occasion an earthquake at Martinique or Guadaloupe. Loud explosions were heard there as well as at Venezuela, but the ground was not convulsed.

These explosions must not be confounded with the rolling noise which everywhere precedes the slightest commotions; they are often heard on the banks of the Orinoco, and (as we were assured by persons living on the spot) between the Rio Arauca and Cuchivero. Father Morello relates that at the Mission of Cabruta the subterranean noise so much resembles discharges of small cannon (pedreros) that it has seemed as if a battle were being fought at a distance. On the 21st of October, 1766, the day of the terrible earthquake which desolated the province of New Andalusia, the ground was simultaneously shaken at Cumana, at Caracas, at Maracaybo, and on the banks of the Casanare, the Meta, the Orinoco, and the Ventuario. Father Gili has described
to Dupuget, 736 toises. Between Vauclin and the feldspar-lavas of the Paps of Carbet is found, as M. Moreau de Jonnès asserts, in a neck of land, a region of early basalt called La Roche Carrée). Thermal waters of Prêcheur and Lameutin.-Dominica, completely volcanic.-Guadaloupe, an active valcano, the height of which, according to Leboucher, is 799 toises ; according to Amie, 850 toises.-Montserrat, a solfatara ; fine porphyritic lavas with large crystals of feldspar and hornblende near Galloway, according to Mr. Nugent.-Nevis, a solfatara.-St. Christopher's, a solfatara at Mount Misery. - St. Eustache, a crater of an extinguished volcano, surrounded by pumice-stone. (Trinidad, which is traversed by a chain of primitive slate, appears to have anciently formed a part of the littoral chain of Cumana, and not of the system of the mountains of the Caribbee Islands.)
these commotions at the Mission of Encaramada, a country entirely granitic, where they were accompanied by loud explosions. Great fallings-in of the earth took place in the mountain Paurari, and near the rock Aravacoto a small island disappeared in the Orinoco. The undulatory motion continued during a whole hour. This seemed the first signal of those violent commotions which shook the coasts of Cumana and Cariaco for more than ten months. It might be supposed that men living in woods, with no other shelter than huts of reeds and palm-leaves, could have little to dread from earthquakes. But at Erevato and Caura, where these phenomena are of rare occurrence, they terrify the Indians, frighten the beasts of the forests, and impel the crocodiles to quit the waters for the shore. Nearer the sea, where shocks are frequent, far from being dreaded by the inhabitants, they are regarded with satisfaction as the prognostics of a wet and fertile year.

In this dissertation on the earthquakes of Terra Firma and on the volcanos of the neighbouring archipelago of the West India Islands, I have pursued the plan of first relating a number of particular facts, and then considering them in one general point of view. Everything announces in the interior of the globe the operation of active powers, which, by mutual reaction, balance and modify one another. The greater our ignorance of the causes of these undulatory movements, these evolutions of heat, these formations of elastic fluids, the more it becomes the duty of persons who apply themselves to the study of physical science to examine the relations which these phenomena so uniformly present at great distances apart. It is only by considering these various relations under a general point of view, and tracing them over a great extent of the surface of the globe, through formations of rocks the most different, that we are led to abandon the supposition of trifling local causes, strata of pyrites, or of ignited coal.*

The following is the series of phenomena remarked on the northern coasts of Cumana, Nueva Barcelona, and Caracas; and presumed to be connected with the causes which pro-

* See "Views of Nature,"-On the structure and action of volcanos in different parts of the world,-p. 353 (Bohn's ed.); also "Cosmos," pp. 199-225 (Bohn's ed.).
duce earthquakes and eruptions of lava. We shall begin with the most eastern extrenity, the island of Trinidad; which seems rather to belong to the shore of the continent than to the system of the mountains of the West India Islands.
I. The pit which throws up asphaltum in the bay of Mayaro, on the eastern coast of the island of Trinidad, southward of Point Guataro. This is the mine of chapapote or mineral tar of the country. I was assured that in the months of March and June the eruptions are often attended with violent explosions, smoke, and flames. Almost on the same parallel, and also in the sea, but westward of the island (near Punta de la Brea, and to the south of the port of Naparaimo), we find a similar vent. On the neighbouring coast, in a clayey ground, appears the celebrated lake of asphaltum (Laguna de la Brea), a marsh, the waters of which have the same temperature as the atmosphere. The small cones situated at the south-western extremity of the island, between Point Icacos and the Rio Erin, appear to have some analogy with the volcanos of air and mud which I met with at Turbaco in the kingdom of New Grenada. I mention these situations of asphaltum on account of the remarkable circumstances peculiar to them in these regions; for I am not unaware that naphtha, petroleum, and asphaltum are found equally in volcanic and secondary regions,* and even more frequently in the latter. Petroleum is found floating on the sea thirty leagues north of Trinidad, around the island of Grenada, which contains an extinguished crater and basalts.
II. Hot Springs of Irapa, at the north-eastern extremity of New Andalusia, between Rio Caribe, Soro, and Yaguarapayo.
III. Air-volcano, or Salce, of Cumacatar, to the south of San Jose and Carupano, near the northern coast of the continent, between La Montaña de Paria and the town of Cariaco. Almost constant explosions are felt in a clayey

[^165]soil, which is affirmed to be impregnated with sulphur. Hot sulphureous waters gush out with such violence that the ground is agitated by very sensible shocks. It is said that flames have been frequently seen issuing out since the great earthquake of 1797 . These facts are well worthy of being examined.
IV. Petroleum-spring of the Buen Pastor, near Rio Areo. Large masses of sulphur have been found in clayey soils at Guayuta, as in the valley of San Bonifacio, and near the junction of the Rio Pao with the Orinoco.
V. The Hot Waters (Aguas Calientes) south of the Rio Azul, and the Hollow Ground of Cariaco, which, at the time of the great earthquake of Cumana, threw up sulphuretted water and viscous petroleum.
VI. Hot waters of the gulf of Cariaco.
VII. Petroleum-spring in the same gulf, near Maniquarez. It issues from mica-slate.
VIII. Flames issuing from the earth, near Cumana, on the banks of the Manzanares, and at Mariguitar, on the southern coast of the gulf of Cariaco, at the time of the great earthquake of 1797.
IX. Igneous phenomena of the mountain of Cuchivano, near Cumanacoa.
X. Petroleum-spring gushing from a shoal to the north of the Caracas Islands. The smell of this spring warns ships of the danger of this shoal, on which there is only one fathom of water.
XI. Thermal springs of the mountain of the Brigantine, near Nueva Barcelona. Temperature $43 \cdot 2^{\circ}$ (centigrade).
XII. Thermal springs of Provisor, near San Diego, in the province of New Barcelona.
XIII. Thermal springs of Onoto, between Turmero and Maracay, in the valleys of Aragua, west of Caracas.
XIV. Thermal springs of Mariara, in the same valleys. Temperature $58.9^{\circ}$.
XV. Thermal springs of Las Trincheras, between Porto Cabello and Valencia, issuing from granite like those of Mariara, and forming a river of warm water (Rio de Aguas Calientes). Temperature $90.4^{\circ}$.
XVI. Boiling springs of the Sierra Nevada of Merida.
XVII. Aperture of Mena, on the borders of Lake Mara-
caybo. It throws up asphaltum, and is said to emit gaseous emanations, which ignite spontaneously, and are seen at a great distance.

These are the springs of petroleum and of thermal waters, the igneous meteors, and the ejections of muddy substances attended with explosions, of which I acquired a knowledge in the vast provinces of Venezuela, whilst travelling over a space of two hundred leagues from east to west. These various phenomena have occasioned great excitement among the inhabitants since the catastrophes of 1797 and 1812: yet they present nothing which constitutes a volcano, in the sense hitherto attributed to that word. If the apertures, which throw up vapours and water with violent noise, be sometimes called volcancitos, it is only by such of the inhsbitants as persuade themselves that volcanos must necessarily exist in countries so frequently exposed to earthquakes. Advancing from the burning crater of St. Vincent in the directions of south, west and south-west, first by the chain of the Caribbee Islands, then by the littoral chain of Cumana and Venezuela, and finally by the Cordilleras of New Grenada, along a distance of three hundred and eighty leagues, we find no active volcano before we arrive at Purace, near Popayan. The total absence of apertures, through which melted substances can issue, in that part of the continent, which stretches eastward of the Cordillera of the Andes, and eastward of the Rocky Mountains, is a most remarkable geological fact.

In this chapter we have examined the great commotions which from time to time convulse the stony crust of the globe, and scatter desolation in regions favoured by the most precious gifts of nature. An uninterrupted calm prevails in the upper atmosphere; but, to use an expression of Franklin, more ingenious than accurate, thunder often rolls in the subterranean atmosphere, amidst that mixture of elastic fluids, the impetuous movements of which are frequently felt at the surface of the earth. The destruction of so many populous cities presents a picture of the greatest calamities which afflict mankind. A people struggling for independence are suddenly exposed to the want of subsistence, and of all the necessaries of life. Famished and without shelter, the inhabitants are dispersed through the
country, and numbers who have escaped from the ruin of their dwellings are swept away by disease. Far from strengthening mutual confidence among the citizens, the feeling of misfortune destroys it; physical calamities augment civil discord; nor does the aspect.of a country bathed in tears and blood appease the fury of the victorious party.

After the recital of so many calamities, the mind is soothed by turning to consolatory remembrances. When the great catastrophe of Caracas was known in the United States, the Congress, assembled at Washington, unanimously decreed that five ships laden with flour should be sent to the coast of Venezuela; their cargoes to be distributed among the most needy of the inhabitants. The generous contribution was received with the warmest gratitude; and this solemn act of a free people, this mark of national interest, of which the advanced civilization of the Old World affords but few examples, seemed to be a valuable pledge of the mutual sympathy which ought for ever to unite the nations of North and South America.

## Chapter XV.

Departure from Caracas.-Mountains of San Pedro and of Los Teques.La Victoria.-Valleys of Aragua.

To take the shortest road from Caracas to the banks of the Orinoco, we should have crossed the southern chain of mountains between Baruta, Salamanca, and the savannahs of Ocumare, passed over the steppes or llanos of Orituco, and embarked at Cabruta, near the mouth of the Rio Guarico. But this direct route would have deprived us of the opportunity of surveying the valleys of Aragua, which are the finest and most cultivated portion of the province; of taking the level of an important part of the chain of the coast by means of the barometer; and of descending the Rio Apure as far as its junction with the Orinoco. A traveller who has the intention of studying the configuration and natural productions of a country is not guided by
distances, but by the peculiar interest attaiched to the regions he may traverse. This powerful motive led us to the mountains of Los Teques, to the hot springs of Mariar, to the fertile banks of the lake of Valencia, and through the immense savannaths of Calebozo to San Fernando de Apure, in the eastern part of the province of Varinas. Having determined on this route, our first direction was westward, then southward, and finally to east-isouth-east, so that we might enter the Orinoco by the Apure in latitude $7^{\circ} 36^{\prime} 23^{\prime \prime}$.

On the day on which we quitted the capital of Venezuels, we reached the foot of the woody mountains which close the valley on the south-west. There we halted for the night, and on the following day we proceeded along the right bank of the Rio Guayra as far as the village of Antimano, by \& very fine road, partly scooped out of the rock. We passed by La Vega and Carapa. The church of $\mathrm{L}_{2}$ Vega rises very picturesquely above a range of hills covered with thick vegetation. Scattered houses surrounded with date-trees seem to denote the comfort of their inhabitants. A chain of low mountains separates the little river Guayra from the valley of La Pascua* (so celebrated in the history of the country), and from the ancient gold-mines of Baruta and Oripoto. Ascending in the direction of Carapa, we enjoy once more the sight of the Silla, which appears like an immense dome with a cliff on the side next the sea. This rounded summit, and the ridge of Galipano crenated like a wall, are the only objects which in this basin of gneiss and mica-slate impress a peculiar character on the landscape. The other mountains have a uniform and monotonous aspect.

A little before reaching the village of Antimano we observed on the right a very curious geological phenomenon. In hollowing the new road out of the rock, two large veins of gneiss were discovered in the mica-slate. They are nearly perpendicular, intersecting all the mica-slate strata, and are

[^166]from six to eight toises thick. These veins contain not fragments, but balls or spheres of granular diabasis,* formed of concentric layers. These balls are composed of lamellar feldspar and hornblende closely commingled. The feldspar approximates sometimes to vitreous feldspar when disseminated in very thin laminæ in a mass of granular diabasis, decomposed, and emitting a strong argillaceous smell: The diameter of the spheres is very unequal, sometimes four or eight inches, sometimes three or four feet; their nucleus, which is more dense, is without concentric layers, and of a very dark green hue, inclining to black. I could not perceive any mica in them; but, what is very remarkable, $I$ found great quantities of disseminated garnets. These garnets are of a very fine red, and are found in the grünstein only. They are neither in the gneiss, which serves as a cement to the balls, nor in the mica-slate, which the veins traverse. The gneiss, the constituent parts of which are in a state of considerable disintegration, contains large crystals of feldspar ; and, though it forms the body of the vein in the mica-slate, it is itself traversed by threads of quartz two inches thick, and of very recent formation. The aspect of this phenomenon is very curious: it appears as if cannonballs were embedded in a wall of rock. I also thought I recognized in these same regions, in the Montaña de Avila, and at Cabo Blanco, east of La Guayra, a granular diabasis, mixed with a small quantity of quartz and pyrites, and destitute of garnets, not in veins, but in subordinate strata in the mica-slate. This position is unquestionably to be found in Europe in primitive mountains; but in general the granular diabasis is more frequently connected with the system of transition rocks, especially with a schist (übergangs-thonschiefer) ábounding in beds of Lydian stone strongly carburetted, of schistose jasper, $\dagger$ ampelites, $\ddagger$ and black limestone.

Near Antimano all the orchards were full of peach-trees loaded with blossom. This village, the Valle, and the banks of the Macarao, furnish great abundance of peaches, quinces,

[^167]and other European fruits for the market of Caracss. Between Antimano and Ajuntas we crossed the Rio Guayra seventeen times. The road is very fatiguing; yet, instead of making a new one, it would perhaps be better to change the bed of the river, which loses a great quantity of water by the combined effects of filtration and evaporation. Each sinuosity forms a marsh more or less extensive. This loss of water is to be regretted in a province, nearly all the cultivated portions of which are extremely dry. The rains are much less frequent and less violent in this place than in the interior of New Andalusia, at Cumanacoa, and on the banks of the Guarapiche. Many of the mountains of Caracas enter the region of the clouds; but the strata of primitive rocks dip at an angle of $70^{\circ}$ or $80^{\circ}$, and generally to northwest, so that the waters are either lost in the interior of the earth, or gush out in copious springs not southward but northward of the mountains of the coast of Niguatar, Avila, and Mariara. The rising of the gneiss and mica-slate strata to the south appears to me to explain in a considerable degree the extreme humidity of the coast. In the interior of the province we meet with portions of land, two or three leagues square, in which there are no springs; consequently sugar-cane, indigo, and coffee, grow only in places where running waters can be made to supply artificial irrigation during very dry weather. The early colonists imprudently destroyed the forests. Evaporation is enormous on a stony soil surrounded with rocks, which radiate heat on every side. The mountains of the coast, like a wall, extending east and west from Cape Codera toward Point Tucacas, prevent the humid air of the shore (that is to say, those inferior strata of the atmosphere resting immediately on the sea, and dissolving the largest proportion of water) from penetrating to the islands. There are few openings, few ravines, which, like those of Catia or of Tipe, lead from the coast to the high longitudinal valleys, and there is no bed of a great river, no gulf allowing the sea to flow inland, spreading moisture by abundant evaporation. In the eighth and tenth degrees of latitude, in regions where the clouds do not, as it were, skim the surface of the soil, many trees are stripped of their leaves in the months of January and February; not by the sinking of the temperature as in

Europe, but because the air at this period, the most distant from the rainy season, nearly attains its maximum of dryness. Only those plants which have very tough and glossy leaves resist this absence of humidity. Beneath the fine sky of the tropics the traveller is struck with the almost hibernal aspect of the country; but the freshest verdure again appears when he reaches the banks of the Orinoco, where another climate prevails; and the great forests preserve by their shade a certain quantity of moisture in the soil, by sheltering it from the devouring heat of the sun.

Beyond the small village of Antimano the valley becomes much narrower. The river is bordered with Lata, a fine gramineous plant with distich leaves, which sometimes reaches the height of thirty feet.* Every hut is surrounded with enormous trees of persea, $\dagger$ at the foot of which the aristolochim, paullinia, and other creepers vegetate. The neighbouring mountains, covered with forests, seem to spread humidity over the western extremity of the valley of Caracas. We passed the night before our arrival at Las Ajuntas at a sugar-cane plantation. A square house (the hacienda or farm of Don Fernando Key-Muñoz) contained nearly eighty negroes; they were lying on skins of oxen spread upon the ground. In each apartment of the house were four slaves: it looked like a barrack. A dozen fires were burning in the farm-yard, where people were employed in dressing food, and the noisy mirth of the blacks almost prevented us from sleeping. The clouds hindered me from observing the stars; the moon appeared only at intervals. The aspect of the landscape was dull and uniform, and all the surrounding hills were covered with aloes. Workmen were employed at a small canal, intended for conveying the waters of the Rio San Pedro to the farm, at a height of more than seventy feet. According to a barometric calculation, the site of the hacienda is only fifty toises above the bed of the Rio Guayra at La Noria, near Caracas.

The soil of these countries is found to be but little favourable to the cultivation of the coffee-tree, which in general is less productive in the valley of Caracas than was imagined

[^168]when the first plantations were made near Chacao. The finest coffee-plantations are now found in the savannah of Ocumare, near Salamanca, and at Rincon, in the mountainous countries of Los Mariches, San Antonio Hatillo, and Los Budares. The coffee of the three last mentioned places, situated eastward of Caracas, is of a superior quality; but the trees bear a smaller quantity, which is attributed to the height of the spot and the coolness of the climate. The greater plantations of the province of Venezuela (as Aguacates, near Valencia and Rincon) yreld in good years a produce of three thousand quintals.

The extreme predilection entertained in this province for the culture of the coffee-tree is partly faunded on the circumstance that the berry can be preserved during a great number of years; whereas, notwithstanding every possible care, cacao spoils in the warehouses after ten or twelve months. During the long dissensions of the European powers, at a time when Spain was too weak to protect the commerce of her colonies, industry was directed in preference to productions of which the sale was less urgent, and could await the chances of political and commercial events. I remarked that in the coffee-plantations the nurseries are formed not so much by collecting together young plants, accidentally rising under trees which have yielded a crop, as by exposing the seeds of coffee to germination during five days, in heaps, between plantain leaves. These seeds are taken out of the pulp, but yet retaining a part of it adherent to them. When the seed has germinated it is sown, and it produces plants capable oí bearing the heat of the sun better than those which spring up in the shade in coffee-plantations. In this country five thousand three hundred coffee-trees are generally planted in a fanega of ground, amounting to five thousand four hundred and seventy-six square toises. This land, if it be capable of artificial irrigation, costs five hundred piastres in the northern part of the province. The coffee-tree flowers only in the second year, and its flowering lasts only twenty-four hours. At this time the shrub has a charming appearanee; and, when seen from afar, it appears covered with snow. The produce of the third year becomes very abundant. In plantations well weeded and watered, and recently culti-
vated, trees will bear sixteen, eighteen, and even twenty pounds of coffee. In general, however, more than a pound and a half or two pounds cannot be expected from each plant; and even this is superior to the mean produce of the West India Islands. The coffee trees suffer much from rain at the time of flowering, as well as from the want of water for artificial irrigation, and also from a parasitic plant, a new species of loranthus, which clings to the branches. When, in plantations of eighty or a hundred thousand shrubs, we consider the immense quantity of organic matter contained in the pulpy berry of the coffee-tree, we may be astonished that no attempts have been made to extract a spirituous liqnor from them.*

If the troubles of St. Domingo, the temporary rise in the price of colonial produce, and the emigration of French planters, were the first causes of the establishment of coffeeplantations on the continent of America, in the island of Cuba, and in Jamaica; their produce has far more than compensated the deficiency of the exportation from the French West India Islands. This produce has augmented in proportion to the population, the change of customs, and the increasing luxury of the nations of Europe. The island

[^169]of St. Domingo exported, in 1700, at the time of Necker's administration, nearly seventy-six million pounds of coffee.*

Tea could be cultivated as well as coffee in the mountainous parts of the provinces of Caracas and Cumana. Every climate is there found rising in stages one above another; and this new culture would succeed there as well as in the southern hemisphere, where the government of Brazil, pro. tecting at the same time industry and religious toleration, suffered at once the introduction of Chinese tea and of the dogmas of Fo. It is not yet a century since the first coffeetrees were planted at Surinam and in the West India Islands, and already the produce of America amounts to fifteen millions of piastres, reckoning the quintal of coffee at fourteen piastres only.

On the eighth of February we set out at sunrise, to cross the Higuerote, a group of lofty mountains, separating the two longitudinal valleys of Caracas and Aragua. After passing, near Las Ajuntas, the junction of the two small rivers San Pedro and Macarao, which form the Rio Guayra, we ascended a steep hill to the table-land of La Buenavista, where we saw a few lonely houses. The view extends on the north-west to the city of Caracas, and on the south to the village of Los Teques. The country has a very wild aspect, and is thickly wooded. We had now gradually lost the plants of the valley of Caracas. $\dagger$ We were eight hun-

* French pounds, containing 9216 grains. 112 English pounds = 103 French pounds; and 160 Spanish pounds $=93$ French pounds. The island of St. Domingo was at that time, it must be remembered, a French colony.
$\dagger$ The Flora of Caracas is characterized chiefly by the following plants, which grow between the heights of four hundred and six hundred toises. Cipura martinicensis, Panicum mieranthum, Parthenium hysterophorus, Vernonia odoratissima, (Pevetera, with flowers having a delicious odour of heliotropium), Tagetes caracasana, T. scoparia of Lagasca (introduced by M. Bonpland into the gardens of Spain), Croton hispidus, Smilar scabriusculus, Limnocharis Humboldti, Rich., Equisetum ramosissimum, Heteranthera alismoildes, Glycine punctata, Hyptis Plumeri, Pavonia cancellata, Cav., Spermacoce rigida, Crotalaria acutifolia, Polygala nemorosa, Stachytarpheta mutabilis, Cardiospermum ulmaceum, Amaranthus caracasanus, Elephantopus strigosus, Hydrolea mollis, Alternanthera caracasana, Eupatorium amydalinum, Elytraria fasciculata, Salvia fimbriata, Angelonia salicaria, Heliotropium strictum, Convolvolus batatilla, Rubus jamaicensis, Dutura arborea, Dalea enneaphylla, Buchnera rosea, Salix Humboldtiana; Willd., Theophrasta longifolia, Tournefortia cara-
dred and thirty-five toises above the level of the ocean, which is almost the height of Popayan; but the mean temperature of this place is probably only $17^{\circ}$ or $18^{\circ}$. The road over these mountains is much frequented; we met continually long files of mules and oxen; it is the great road leading from the capital to La Victoria, and the valleys of Aragua. This road is cut out of a talcose gneiss* in a state of decomposition. A clayey soil mixed with spangles of mica covered the rock, to the depth of three feet. Travellers suffer from the dust in winter, while in the rainy season the place is changed into a slough. On descending the table-land of Buenavista, about fifty toises to the south-east, an abundant spring, gushing from the gneiss, forms several cascades surrounded with thick vegetation. The path leading to the spring is so steep that we could bouch with our hands the tops of the arborescent ferns, the trunks of which reach a height of more than twenty-five feet. The surrounding rocks are covered with jungermannias and hypnoid mosses. The torrent, formed by the spring, and shaded with heliconias, uncovers, as it falls, the roots of the plumerias, $\dagger$ cupeys, ${ }^{+}$ browneas, and Ficus gigantea. This humid spot, though
casana, Inga cinerea, I. ligustrina, I. sapindioİdes, I. fastuosa, Schwenkia patens, Erythrina mitis. The most agreeable places for herborizing near Caracas are the ravines of Tacagua, Tipe, Cotecita, Catoche, Anauco, and Chacaito.
* The direction of the strata of gneiss varies; it is either hor. $3 \cdot 4$, dipping to the N.W. or hor. $8 \cdot 2$, dipping to the S.E.
$\dagger$ The red jasmine-tree, frangipanier of the French West India Islands. The plumeria, so common in the gardens of the Indians, has been very seldom found in a wild state. It is mixed here with the Piper flagellare, the spadix of which sometimes reaches three feet long. With the new kind of fig-tree (which we have called Ficus gigantea, because it frequently attains the height of a hundred feet), we find in the mountains of Buenavista and of Los Teques, the Ficus nymphæifolia of the garden of Schönbrunn, introduced into our hot-houses by M. Bredemeyer. I am certain of the identity of the species found in the same places; but I doubt really whether it be really the F. nymphæifolia of Linnæus, which is supposed to be a native of the East Indies.
$\ddagger$ In the experiments I made at Caracas, on the air which circulates in plants, I was struck with the fine appearance presented by the petioles and leaves of the Clusia rosea, when cut open under water, and exposed to the rays of the sun. Each trachea gives out a current of gas, purer by 0.08 than atmospLeric air. The phenomenon ceases the moment the apparatus is placed in the shade. There is only a very slight disengageVOL. 1.
infested by serpents, presents a rich harvest to the botsnist The Brownea, which the inhabitants call rosa del monte, or palo de cruz, bears four or five hundred purple flowers together in one thyrsus; each flower has invariably eleven atamina, and this majestic plant, the trunk of which grows to the height of fifty or sixty feet, is becoming rare, becanse its wood yields a highly valued charcoal. The soil is covered with pines (ananas), hemimeris, polygala, and melastomas. A climbing gramen* with its light festoons unites trees, the presence of which attests the coolness of the climate of these mountains. Such are the Aralia capitata, $\dagger$ the Vismis caparosa, and the Clethra fagifolia. Among these plants, peculiar to the fine region of the arborescent ferns, $\ddagger$ some palm-trees rise in the openings, and some scattered groups of guarumo, or cecropia with silvery leaves. The trunks of the latter are not very thick, and are of a black colour towards the summit, as if burnt by the oxygen of the atmosphere. We are surprised to find so noble a tree, which has the port of the theophrasta and the palm-tree, bearing generally only eight or ten terminal leaves. The ants, which inhabit the trunk of the guarumo, or jarsome, and destror its interior cells, seem to impede its growth. We had already.made one herborization in the temperate mountains of the Higuerote in the month of December, accompanying the capitan-general, Señor de Guevara, in an excursion with the intendant of the province to the Valles de Aragus M. Bonpland then found in the thickest part of the forest some plants of aguatire, the wood of which, celebrated for its fine red colour, will probably one day become an article of exportation to Europe. It is the Sickingia erythroxylon described by Bredemeyer and Willdenow.
ment of air at the two surfaces of the leaves of the clusia exposed to the sun without being cut open. The gas enclosed in the capsules of the Cardiospermum vesicarium appeared to me to contain the same proportion of oxygen as the atmosphere, while that contained between the knots, in the hollow of the stalk, is generally less pure, containing only fros 0.12 to 0.15 of oxygen. It is necessary to distinguish between the ai circulating in the trachex, and that which is stagnant in the great cavitie of the stems and pericarps.
* Carice. See p. 207.
+ Candelero. We found it also at La Cumbre, at a height of 700 toises.
$\ddagger$ Called by the inhabitants of the country 'Region de les helechos.'

Descending the woody mountain of the Higuerote to the south-west, we reached the small village of San- Pedro, situated in a basin where several valleys meet, and almost three hundred toises lower than the table-land of Buenavista. Plantain-trees, potatoes, ${ }^{*}$ and coffee are cultivated together on this spot. The village is very small, and the church not yet fimished. We met at an inn (pulperia) several European Spaniards employed at the government tobacco farm. Their dissatisfaction formed a strange contrast to our feelings. They were fatigued with their journey, and they vented their displeasure in complaints and maledictions on the wretched country, or to use their own phrase, estas tierras infelices, in which they were doomed to live. We, on the other hand, were enchanted with the wild scenery, the fertility of the soil, and the mildness of the climate. Near San Pedro, the talcose gneiss of Buenavista passes into a mica-slate filled with garnets, and containing subordinate beds of serpentine. Something analogous to this is met with at Zöblitz in Saxony. The serpentine, which is very pure and of a fine green, varied with spots of a lighter tint, often appears only superimposed on the mica-slate. I found in it a few garneta, bat no metalloid diallage.

The valley of San Pedro, through which flows the river of the same name, separates two great masses of mountains, the Higuerote and Las Cocuyzas. We ascended westward in the direction of the small farms of Las Lagunetos and Garavatos. These are solitary houses, which serve as inns, and where the mule-drivers obtain their favourite beverage, the guarapo, or fermented juice of the sugar-cane: intoxication is very common among the Indians who frequent this road. Near Garavatos there is a mica-slate rock of singular form ; it is a ridge, or steep wall, crowned by a tower. We opened the barometer at the highest point of the mountain Las Cocuyzas, $\dagger$ and found ourselves almost at the same elevation as on the table-land of Buenavista, which is scarcely ten toises higher.

The prospect at Las Lagunetas is extensive, but pather uniform. This mountainous and uncultivated tract of ground
> * Solanum tuberosum. $\dagger$ Absolnte height 845 toiseas.
between the sources of the Guayra and the Tuy is more than twenty-five square leagues in extent. We there found only one miserable village, that of Los Teques, south-east of San Pedro. The soil is as it were furrowed by a multitude of valleys, the smallest of which, parallel with each other, terminate at right angles in the largest valleys. The back of the mountains presents an aspect as monotonous as the ravines; it has no pyramidal forms, no ridges, no steep -declivities. I am inclined to think that the undulation of this ground, which is for the most part very gentle, is less owing to the nature of the rocks, (to the decomposition of the gneiss for instance), than to the long presence of the water and the action of currents. The limestone mountains of Cumana present the same phenomenon north of Tumiriquiri.

From Las Lagunetas we descended into the valley of the Rio Tuy. This western slope of the mountains of Los Teques bears the name of Las Cocuyzas,and it is covered with two plants with agave leaves; the maguey of Cocuyza, and the maguey of Cocuy. The latter belongs to the genus Yucca.* Its sweet and fermented juice yields a spirit by distillation; and I have seen the young leaves of this plant eaten. The fibres of the full-grown leaves furnish cords of extraordinary strength. $\dagger$ Leaving the mountains of the Higuerote and Los Teques, we entered a highly cultivated country, covered with hamlets and villages; several of which would in Europe be called towns. From east to west, on a line of twelve leagues in extent, we passed La Victoria, San Mateo, Turmero, and Maracay, containing together more than 28,000 inhabitants. The plains of the Tuy may be considered as the eastern extremity of the valleys of Aragua, extending from Guigne, on the borders of the lake of Valencia, as far as the foot of Las Cocuyzas. A barometrical measurement gave me 295 toises for the absolute height of the Valle del Tuy, near the farm of Manterola, and 222 toises for that of the surface of the lake. The Rio Tuy, flowing from the mountains of Las Cocuyzas, runs first towards the west, then turning to the south and to the east,

- Yucca acaulis, Humb.
+ At the clock of the cathedral of Caracas, a cord of maguey, half an inch in diametar, sustained for fifteen years a weight of $\mathbf{3 5 0}$ pounds.
it takes its course along the high savannahs of Ocumare, receives the waters of the valley of Caracas, and reaches the sea near cape Codera. It is the small portion of its basin in the westward direction which, geologically speaking, would seem to belong to the valley of Aragua, if the hills of calcareous tufa, breaking the continuity of these valleys between Consejo and La Victoria, did not deserve some consideration. We shall here again remind the reader that the group of the mountains of Los Teques, eight hundred and fifty toises high, separates two longitudinal valleys, formed in gneiss, granite, and mica-slate. The most eastern of these valleys, containing the capital of Caracas, is 200 toises higher than the western valley, which may be considered as the centre of agricultural industry.

Having been for a long time accustomed to a moderate temperature, we found the plains of the Tuy extremely hot, although the thermometer kept, in the day-time, between eleven in the morning and five in the afternoon, at only $23^{\circ}$ or $24^{\circ}$. The nights were delightfully cool, the temperature falling as low as $17 \cdot 5^{\circ}$. As the heat gradually abated, the air became more and more fragrant with the odour of flowers. We remarked above all the delicious perfume of the Lirio hermoso,* a new species of pancratium, of which the flower, eight or nine inches long, adorns the banks of the Rio Tuy. We spent two very agreeable days at the plantation of Don Jose de Manterola, who in his youth had accompanied the Spanish embassy to Russia. The farm is a fine plantation of sugar-canes; and the ground is as smooth as the bottom of a drained lake. The Rio Tuy winds through districts covered with plantains, and a little wood of Hura crepitans, Erythrina corallodendron, and fig-trees with nymphæa leaves. The bed of the river is formed of pebbles of quartz. I never met with more agreeable bathing than in the Tuy. The water, as clear as crystal, preserves even during the day a temperature of $18.6^{\circ}$; a considerable coolness for these climates, and for a height of three hundred toises; but the sources of the river are in the surrounding mountains. The house of the proprietor, situated on a hillock, of fifteen or twenty toises of elevation, is surrounded by.the huts of the negroes. Those who are

[^170]masried provide food for themselves; and here, as everywhere clse in the valleys of Aragua, a small spot of ground is allotted to them to cultivate. They labour on that ground on Saturdays and Sundays, the only days in the week on which they are free. They keep poultry, and sometimes even a pig. Their masters boast of their happiness, as in the north of Earope the great landholders love to descant upon the ease enjoyed by peasants who are attached to the glebe. On the day of our arrival we saw three fugitive negroes brought back ; they were slaves newly purchased. I dreaded having to witness one of those punishments which, wherever slavery prevails, destroys all the charm of a country life. Happily these blacks were treated with humanity.

In this plantation, as in all those of the province of Venezuela, three species of sugar-cane can be distinguished even at a distance by the colour of their leaves; the old Creole sugar-cane, the Otaheite cane, and the Batavia cane. The first has a deep-green leaf, the stem not very thick, and the knots rather near together. This sugar-cane was the first introduced from India into Sicily, the Camary Islands, and West Indies. The second is of a lighter green; and its stem is higher, thicker, and more succulent. The whole plant exhibits a more luxuriant vegetation. We owe this plant to the voyages of Bougainville, Cook, and Bligh. Bougainville carried it to the Mauritius, whence it passed to Cayenne, Martinique, and, since 1792, to the rest of the West India Islands. The sugar-cane of Otaheite, called by the people of that island $T 0$, is one of the most important aequisitions for which colonial agriculture is indebted to the travels of naturalists. It yields not only one-third more juice than the creolian cane on the same space of ground; but from the thickpess of its stem, and the tenacity of its ligneous fibres, it furnishes much more fuel. This last advantage is important in the West Indies, where the destruction of the forests has long obliged the planters to use canes deprived of juice, to keep up the fire under the boilers. But for the knowledge of this new plant, together with the progress of agriculture on the continent of Spanish America, and the introduction of the East India and Jara sugar, the prices of colonial produce in Europe would have been much more sensibly affected by the revolutions of St.

Domingo, and the destruction of the great sugar plantations of that island. The Otaheite sugar-cane was carried from the island of Trinidad to Caracas, under the name of Caña solera, and it passed from Caracas to Cucuta and San Gil in the kingdom of New Grenada. In our days its cultivation during twenty-five years has almost entirely removed the apprehension at first entertained, that being transplanted to America, the cane would by degrees degenerate, and become as slender as the creole cane. The third species, the violet sugar-cane, called Caña de Batavia, or de Guinea, is certainly indigenous in the island of Java, where it is cultivated in preference in the districts of Japara and Pasuruan. Its foliage is purple and very broad; and this cane is preferred in the province of Caracas for rum. The tablones, or grounds planted with sugar-canes, are divided by hedges of a colossal gramen; the lata, or gynerium, with distich leaves. At the Tuy, men were employed in finishing a dyke, to form a canal of irrigation. This enterprise had cost the proprietor seven thousand piastres for the expense of labour, and four thousand piastres for the costs of lawsuits in which he had become engaged with his neighbours. While the lawyers were disputing about a canal of which only one-half was finished, Don Jose de Manterola began to doubt even of the possibility of carrying the plan into execution. I took the level of the ground with a lunette d'epreuve, on an artificial horizon, and found, that the dam had been constructed eight feet too low. What sums of money have I seen expended uselessly in the Spanish colonies, for undertakings founded on erroneous levelling!

The valley of the Tuy has its 'gold mine,' like almost every part of America inhabited by whites, and backed by primitive mountains. I was assured, that in 1780, foreign gold-gatherers had been engaged in picking up grains of that metal, and had established a place for washing the sand in the Quebrada del Oro. An overseer of a neighbouring plantation had followed these indications; and after his death, a waistcoat with gold buttons being found among his clothes, this gold, according to the logic of the people here, could only have proceeded from a vein, which the falling-in of the earth had rendered invisible. In vain I objected, that I conld

* Raflies, Fifistory of Jeva, tom. i. p. 124.
not, by the mere view of the soil, without digging a large trench in the direction of the vein, judge of the existence of the mine; I was compelled to yield to the desire of my hosts. For twenty years past the overseer's waistcoat had been the subject of conversation in the country. Gold extracted from the bosom of the earth is far more alluring in the eyes of the vulgar, than that which is the produce of agricultural industry, favoured by the fertility of the soil, and the mildness of the climate.

North-west of the Hacienda del Tuy, in the northern range of the chain of the coast, we find a deep ravine, called the Quebrada Seca, because the torrent, by which it was formed, loses its waters through the crevices of the rock, before it reaches the extremity of the ravine. The whole of this mountainous country is covered with thick vegetation. We there found the same verdure as had charmed us by its freshness in the mountains of Buenavista and Las Lagunetas, wherever the ground rises as high as the region of the clouds, and where the vapours of the sea have free access. In the plains, on the contrary, many trees are stripped of a part of their leaves during the winter; and when we descend into the valley of the Tuy, we are struck with the almost hibernal aspect of the country. The dryness of the air is such that the hygrometer of Deluc keeps day and night between $36^{\circ}$ and $40^{\circ}$. At a distance from the river scarcely any huras or pipertrees extend their foliage over thickets destitute of verdure. This seems owing to the dryness of the air, which attains its maximum in the month of February; and not, as the European planters assert, " to the seasons of Spain, of which the empire extends as far as the torrid zone." It is only plants transported from one hemisphere to the other, which, in their organic functions, in the development of their leaves and flowers, still retain their affinity to a distant climate : faithful to their habits, they follow for a long time the periodical changes of their native hemisphere. In the province of Venezuela the trees stripped of their foliage begin to renew their leaves nearly a month before the rainy season. It is probable, that at this period the electrical equilibrium of the air is already disturbed, and the atmosphere, although not yet clouded, becomes gradually more
humid. The azure of the sky is paler, and the elevated regions are loaded with light vapours, uniformly diffused. This season may be considered as the awakening of nature; it is a spring which, according to the received language of the Spanish colonies, proclaims the beginning of winter, and succeeds to the heats of summer.*

Indigo was formerly cultivated in the Quebrada Seca; but as the soil covered with vegetation cannot there concentrate so much heat as the plains and the bottom of the Tuy valley receive and radiate, the cultivation of coffee has been substituted in its stead. As we advanced in the ravine we found the moisture increase. Near the Hato, at the northern extremity of the Quebrada, a torrent rolls down over sloping beds of gneiss. An aqueduct was being formed there to convey the water to the plain. Without irrigation, agriculture makes no progress in these climates. A tree of monstrous size fixed our attention. $\dagger$ It lay on the slope of the mountain, above the house of the Hato. On the least dislodgment of the earth, its fall would have crushed the habitation which it shaded : it had therefore been burnt near its foot, and cut down in such a manner, that it fell between some enormous fig-trees, which prevented it from rolling into the ravine. We measured the fallen tree; and though its summit had been burnt, the length of its trunk was still one hundred and fifty-four feet. $\ddagger$ It was eight feet in diameter near the roots, and four feet two inches at the upper extremity.

Our guides, less anxious than ourselves to measure the bulk of trees, continually pressed us to proceed onward and seek the 'gold mine.' This part of the ravine is little frequented, and is not uninteresting. We made the following observations on the geological constitution of the soil. At the entrance of the Quebrada Seca we remarked great masses of primitive saccharoidal limestone, tolerably fine

[^171]grained, of a bluish tint, and traversed by veins of caisareous spar of daguling whiteness. These calcareous masses must not be confounded with the very recent depositions of tufa, or carbonate of lime, which fill the plains of the Tur; they form beds of mica-slate, passing into talc-slate.* The primitive limestone often simply covers this latter rock in concordant stratification. Very near the Hato the talcose slate becomes entirely white, and contains small layers of soft and unctuous graphic ampelite. $\dagger$ Some pieces, destitute of veins of quartz, are real granular plumbago, which might be of use in the arts. The aspect of the rock is very singular in those places where thin plates of black ampelite alternate with thin, sinuous, and satiny plates of a talcose slate as white as snow. It would seem as if the carbon and iron, which in other places colour the primitive rocks, are here concentrated in the subordinate strata.

Turning westward we reached at length the ravine of gold (Quebrada del Oro). On examining the slope of a hill, we could hardly reeognize the vestige of a vein of quartz. The falling of the earth caused by the rains had changed the surface of the ground, and rendered it impossible to make any observation. Great trees were growing in the places where the gold-washers had worked twenty years before. It is probable that the mica-slate contains here, as near Goldcronach in Franconia, and in Salzburgh, auriferous veins; but how is it possible to judge whether they be worth the expense of being wrought, or whether the ore is only in nodules, and in the less abundance in proportion as it is rich? We made a long herborization in a thick forest, extending beyomd the Hato, and abounding in cedrelas, browneas, and fig-trees with nymphsea leaves. The trunks of these last are covered with very odoriferous plants of vanilla, which in general flower only in the month of April. We were here again struck with those ligneous excrescences, which in the form of ridges, or ribs, augment to the height of twenty feet above the ground, the thickness of the trunk of the fig-trees of America. I found

[^172]$\dagger$ Zeichenechrefer.
trees twenty-two feet and a half in diameter near the roots. These ligneous ridges sometimes separate from the trunk at a height of eight feet, and are transformed into cylindrical roots two feet thick. The tree looks as if it were supported by buttresses. This seaffolding however does not penetrate very deep into the earth. The lateral roots wind at the surface of the ground, and if at twenty feet distance from the trunk they are cut with a hatchet, we see gushing out the milky juice of the fig-tree, which, when deprived of the vital influence of the organas of the tree, is altered and coagulates. What a wonderful combination of cells and vessels exist in these vegetable masses, in these gigantic trees of the torrid zone, which without interruption, perhaps during the space of a thousand years, prepare nutritious fluids, raise them to the height of one hundred and eighty feet, convey them down again to the ground, and conceal, beneath a rough and hard bark, under inanimate layers of ligneous matter, all the movements of organic life!

I availed myself of the clearness of the nights, to observe at the plantation of Tuy two emersions of the first and third satellites of Jupiter. These two observations gave, according to the tables of Delambre, long. $4^{\mathrm{h}} 39^{\prime} 14^{\prime \prime}$; and by the chronometer I found $4^{4} 39^{\prime} 10^{\prime \prime}$. During my stay in the valleys of the Tuy and Aragua the zodiacal light appeared almost every night with extraordinary brilliancy. I had perceived it for the first time between the tropics at Caracas, on the 18th of January, after seven in the evening. The point of the pyramid was at the height of $53^{\circ}$. The light totally disappeared at $9^{\text {a }} 35^{\prime}$ (apparent time), nearly $3^{\text {b }} 50^{\prime}$ after sunset, without any diminution in the serenity of the sky. La Caille, in his voyage to Rio Janeiro and the Cape, was struck with the beautiful appearance displayed by the zodiacal light within the tropics, not so much on account of its less inclined position, as of the greater transparency of the air.* It may appear singular, that Childrey and Dominic Cassini, navigators who were well acquainted with the seas of the two Indies, did not at a much earlier period direct the attention of scientific Europe to this light, and its regular form and progress. Until the middle of the

* The great serenity of the air caused this phenomenon to be remarked, in 1668, in the arid plains of Persia.
eighteenth century mariners were little interested by anything not having immediate relation to the course of a ship, and the demands of navigation.

However brilliant the zodiacal light in the dry valley of Tuy, I have observed it more beautiful still at the back of the Cordilleras of Mexico, on the banks of the lake of Tezcuco, eleven hundred and sixty toises above the surface of the ocean. In the month of January, 1804, the light rose sometimes to more than $60^{\circ}$ above the horizon. The Milky Way appeared to grow pale compared with the brilliancy of the zodiacal light; and if small, bluish, scattered clouds were accumulated toward the west, it seemed as if the moon were about to rise.

I must here relate another very singular fact. On the 18th of January, and the 15th of February, 1800, the intensity of the zodiacal light changed in a very perceptible manner, at intervals of two or three minutes. Sometimes it was very faint, at others it surpassed the brilliancy of the Milky Way in Sagittarius. The changes took place in the whole pyramid, especially toward the interior, far from the edges. During these variations of the zodiacal light, the hygrometer indicated considerable dryness. The stars of the fourth and fifth magnitude appeared constantly to the naked eye with the same degree of light. No stream of vapour was visible: nothing seemed to alter the transparency of the atmosphere. In other years I saw the zodiacal light augment in the southern hemisphere half an hour before its disappearance. Cassini admitted "that the zodiacal light was feebler in certain years, and then returned to its former brilliancy." He thought that these slow changes were connected with "the same emanations which render the appearance of spots and facula periodical on the solar disk." But this excellent observer does not mention those changes of intensity in the zodiacal light which I have several times remarked within the tropics, in the space of a few minutes. Mairan asserts, that in France it is common enough to see the zodiacal light, in the months of Februarr and March, mingling with a kind of Aurora Borealis, which he calls 'undecided,' and the nebulous matter of which spreads itself all around the horizon, or appears toward the west. I very much doubt, whether, in the observations I
have been describing, there was any mixture of these two species of light. The variations in intensity took place at considerable altitudes ; the light was white, and not coloured; steady, and not undulating. Besides, the Aurora Borealis is so seldom visible within the tropics, that during five years, though almost constantly sleeping in the open air, and observing the heavens with unremitting attention, I never perceived the least traces of that phenomenon.

I am rather inclined to think that the variations of the zodiacal light are not all appearances dependent on certain modifications in the state of our atmosphere. Sometimes, during nights equally clear, I sought in vain for the zodiacal light, when, on the previous night, it had appeared with the greatest brilliancy. Must we admit that emanations which reflect white light, and seem to have some analogy with the tails of comets, are less abundant at certain periods? Researches on the zodiacal light have acquired a new degree of interest since geometricians have taught us that we are ignorant of the real causes of this phenomenon. The illustrious author of "La Mécanique Céleste" has shown that the solar atmosphere cannot reach even the planet Mercury; and that it could not in any case display the lenticular form which has been attributed to the zodracal light. We may also entertain the same doubts respecting the nature of this light, as with regard to that of the tails of comets. Is it in fact a reflected or a direct light?

We left the plantation of Manterola on the 11th of February, at sunrise. The road runs along the smiling banks of the Tuy; the morning was cool and humid, and the air seemed embalmed by the delicious odour of the Pancratium undulatum, and other large liliaceous plants. In our way to La Victoria, we passed the pretty village of Mamon or of Consejo, celebrated in the country for a miraculous image of the Virgin. A little before we reached Mamon, we stopped at a farm belonging to the family of Monteras. A negress more than a .hundred years old was seated before a small hut built of earth and reeds. Her age was known because she was a creole slave. She seemed still to enjoy very good health. "I keep her in the sun" (la tengo al sol), said her grandson; "the heat keeps her alive."

This appeared to us not a very agreeable mode of prolonging life, for the sun was darting his rays atmost perpendicularly. The brown-skinned nations, blacks well seasoned, and Indians, frequently attain a very advanced age in the torrid zone. A native of Peru named Hilario Pari died at the extraordinary age of one hundred and forty-three yeara, after having been ninety years married.

Don Francisco Montera and his brother, a well-informed young priest, accompanied us with the view of conducting us to their house at La Victoria. Almost all the families with whom we had lived in friendship at Caracas were assembled in the fine valleys of Aragua, and they ried with each other in their efforts to render our stay agreeable. Before we planged into the forests of the Orimoco, we enjoyed once more all the advantages which advanead civilization affords.

The road from Mamon to La Victoria rums south and south-west. We soon lost sight of the river Tuy, which, turning eastward, forms an elbow at the foot of the high mountains of Guayraima. As we drew nearer to Victoria the ground became smoother; it seemed like the bottom of a lake, the waters of which had been drained off. We might have fancied ourselves in the valley of Hasli, in the canton of Berne. The neighbouring hills, only one hundred ${ }^{\boldsymbol{p}}$ and forty toises in height, are composed of calcareous tufa; but their abrupt declivities project like promontories on the plain. Their form indicates the ancient shore of the lake. The eastern extremity of this valley is parched and uncultivated. No advantage has been derived from the ravines which water the neighbouring mountains; but fine cultivation is commencing in the proximity of the town. I say of the town, though in my time Victoria was comsidered only as a village (pueblo).

The environs of La Victoria present a very remarkable agricultural aspect. The height of the cultivated ground is from two hundred and seventy to three hundred toises above the level of the ocean, and yet we there find fields of corn mingled with plantations of sugar-cane, coffee, and plantains. Excepting the interior of the island of Cubs,* we scarcely find elsewhere in the equinoctisl regions * The district of Quatro Villas.

European corn cultivated in large quantities in so low a region. The fine fields of wheat in Mexico are between six hundred and twelve hundred toises of absolute elevation; and it is rave to see them descend to four hundred toises. We shall soon perceive that the produce of grain augments sensibly, from high latitudes towards the equator, with the mean temperature of the climate, in comparing spots of different elevations. The success of agriculture depends on the dryness of the air; on the rains distributed through different seasons, or aceumulated in one season; on winds blowing constantly from the east; or bringing the cold air of the north into very low latitudes, as in the gulf of Mexico; on mists, which for whole months diminish the intensity of the solar rays; in short, on a thousand loeal circumstances which have less influence on the mean temperature of the whole year than on the distribution of the same quantity of heat through the different parts of the year. It is a striking spectacle to see the grain of Europe cultivated from the equator as far as Lapland in the latitude of $69^{\circ}$, in regions where the mean heat is from $22^{\circ}$ to $-2^{\circ}$, in every place where the temperature of summer is above $9^{\circ}$ or $10^{\circ}$. We know the minimum of heat requisite to ripen wheat, barley, and oats; but we are less certain in respect to the maximum which these species of grain, accommodating as they are, can support. We are even ignorant of all the circumstances which favour the culture of corn within the tropics at very small heights. La Victoria and the neighbouring village of San Mateo yield an annual produce of four thousand quintals of wheat. It is sown in the month of December, and the harvest is reaped on the seventieth or seventy-fifth day. The grain is large, white, and abounding in gluten; its pellicle is thinner and not so hard as that of the wheat of the very cold table-lands of Mexico. An acre* near Victoria generally yields from three thousand to three thousand two hundred pounds weight of wheat. The average produce is consequently here, as at Buenos Ayres, three or four times as much as that of northern countries. Nearly sixteenfold of the quantity of seed is reaped; while, according to Lavoisier,

* An avpent des saus et forets, or legal acre of France, of which 1.95 $=1$ hectare. It is ahourt $1 \neq$ acre English.
the surface of France yields on an average only five or six for one, or from one thousand to twelve hundred pounds per acre. Notwithstanding this fecundity of the soil, and this happy influence of the climate, the culture of the sugar-cane is more productive in the valleys of Aragua than that of corn.

La Victoria is traversed by the little river Calanchas, running, not into the Tuy, but into the Rio Aragua: it thence results that this fine country, producing at once sugar and corn, belongs to the basin of the lake of Valencia, to a system of interior rivers not communicating with the sea. The quarter of the town west of the Rio Calanchas is called la otra banda; it is the most commercial part; merchandize is everywhere exhibited, and ranges of shops form the streets. Two commercial roads pass through La Victoria, that of Valencia, or of Porto Cabello, and the road of Villa de Cura, or of the plains, called camino de los Llanos. We here find more whites in proportion than at Caracas. We visited at sunset the little hill of Calvary, where the view is extremely fine and extensive. We discover on the west the lovely valleys of Aragua, a vast space covered with gardens, cultivated fields, clumps of wild trees, farms, and hamlets. Turning south and south-east, we see, extending as far as the eye can reach, the lofty mountains of La Palma, Guayraima, Tiara, and Guiripa, which conceal the immense plains or steppes of Calabozo. This interior chain stretches westward along the lake of Valencia, towards the Villa de Cura, the Cuesta de Yusma, and the denticulated mountains of Guigne. It is very steep, and constantly covered with that light vapour which in hot climates gives a vivid blue tint to distant objects, and, far from concealing their outlines, marks them the more strongly. It is believed that among the mountains of the interio: shain, that of Guayraima reaches an elevation of twelve nundred toises. I found in the night of the eleventh of February the latitude of La Victoria $10^{\circ} 13^{\prime} 35^{\prime \prime}$, the magnetic dip $40^{\circ} 8^{\circ}$, the intensity of the forces equal to 236 oscillations in ten minutes of time, and the variation of the needle $4.4^{\circ}$ north-east.

We proceeded slowly on our way by the villages of San Mateo, Turmero, and Maracay, to the Hacienda de Cura, a
fine plantation belonging to Count Tovar, where we arrived on the evening of the fourteenth of February. The valley, which gradually widens, is bordered with hills of calcareous tufa, called here tierra blanca. The scientific men of the country have made several attempts to calcine this earth, mistaking it for the porcelain earth proceeding from decomposed strata of feldspar. We stayed some hours with a very intelligent family, named Ustariz, at Concesion. Their house, which contains a collection of choice books, stands on an eminence, and is surrounded by plantations of coffee and sugar-cane. A grove of balsam-trees (balsamo*) gives coolness and shade to this spot. It was gratifying to observe the great number of scattered houses in the valley inhabited by freedmen. In the Spanish colonies, the laws, the institutions, and the manners, are more favourable to the liberty of the negroes than in other European settlements.

San Mateo, Turmero, and Maracay, are charming villages, where everything denotes the comfort of the inhabitants. We seemed to be transported to the most industrious districts of Catalonia. Near San Mateo we find the last fields of wheat, and the last mills with horizontal hydraulic wheels. A harvest of twenty for one was expected; and, as if that produce were but moderate, I was asked whether corn yielded more in Prussia and in Poland. By an error generally prevalent under the tropics, the produce of grain is supposed to degenerate in advancing towards the equator, and harvests are believed to be more abundant in northern climates. Since calculations have been made on the progress of agriculture in the different zones, and on the temperatures under the influence of which corn will flourish, it has been found that, beyond the latitude of $45^{\circ}$, the produce of wheat is nowhere so considerable as on the northern coasts of Africa, and on the table-lands of New Grenada, Peru, and Mexico. Without comparing the mean temperature of the whole year, but only the mean temperature of the season which embraces the corn cycle of vegetation, we find for three months of summer, $\dagger$ in the north of Europe, from $15^{\circ}$ to $19^{\circ}$; in Bar-

[^173]$\dagger$ The mean heat of the summers of Scotland in the environs of vol. I. 2 ㅍ
bary and in Egypt, from $27^{\circ}$ to $29^{\circ}$; within the tropies, between fourteen and three hundred toises of height, from $14^{\circ}$ to $25.5^{\circ}$ of the centigrade thermometer.

The fine harvests of Egypt and of Algiers, as well as those of the valleys of Aragua and the interior of the island of Cuba, sufficiently prove that the augmentation of heat is not prejudicial to the harvest of wheat and other alimentary grain, unless it be attended with an excess of drought or moisture. To this circumstance no doubt we must attribute the apparent anomalies sometimes observed within the tropics, in the lower limit of corn. We are astonished to see, eastward of the Havannah, in the famous district of Quatro Villas, that this limit descends almost to the level of the ocean; whilst west of the Havannah, on the slope of the mountains of Mexico and Xalapa, at six hundred and seventy-seven toises of height, the luxuriance of vegetation is such, that wheat does not form ears. At the beginning of the Spanish conquest, the corn of Europe was cultivated with success in several regions now supposed to be too hot, or too damp, for this branch of agriculture. The Spaniards on their first removal to America were little accustomed to live on maize. They still adhered to their European habits. They did not calculate whether corn would be less profitable than coffee or cotton. They tried seeds of every kind, making experiments the more boldly because their reasonings were less founded on false theories. The province of Carthagena, crossed by the chain of the mountains Maris and Guamoco, produced wheat till the sixteenth century. In the province of Caracas, this culture is of very ancient date in the mountainous lands of Tocuyo, Quibor, and Bar-

[^174]quesimeto, which connect the littoral chain with the Bierra Nevada of Merida. Wheat is still successfully cultivated there, and the environs of the town of Tocuyo alone export annually more than eight thousand quintals of excellent flour. But, though the province of Caracas, in its vast extent, includes several spots very favourable to the cultivation of European corn, I believe that in general this branch of agriculture will never acquire any great importance there. The most temperate valleys are not sufficiently wide; they are not real table-lands; and their mean elevation above the level of the sea is not so considerable but that the inhabitants cannot fail to perceive that it is more their interest to establish plantations of coffee, than to cultivate corn. Flour nowcomes to Caracas either from Spain or from the United States.

The village of Turmero is four leagues distant from San Mateo. The road leads through plantations of sugar, indigo, cotton, and coffee. The regularity observable in the construction of the villages, reminded us that they all owe their origin to monks and missions. The streets are straight and parallel, crossing each other at right angles; and the church is invariably erected in the great square, situated in the centre of the village. The church of Turmere is a fine edifiee, but overloaded with architectural ornaments. Since the missionaries have been replaced by vicars, the whites have mingled their habitations with those of the Indians. The latter are gradually disappearing as a separate race; that is to say, they are represented in the general statement of the population by the Mestizoes and the Zamboes, whose numbers daily increase. I still found, however, four thousand tributary Indians in the valleys of Aragua. Those of Turmero and Guacara are the most numerous. They are of small stature, but less squat than the Chaymas; their eyes denote more vivacity and intelligence, owing less perhaps to a diversity in the race, than to a superior state of civilization. They work like freemen by the day. Though active and laborious during the short time they allot to labour, yet what they earn in two months is spent in one week, in the purchase of strong liquors at the small inns, of which unhappily the numbers daily increase.

We saw at Turmero the remains of the assembled militia.
of the country, and their appearance alone sufficiently indicated that these valleys had enjoyed for ages undisturbed peace. The capitan-general, in order to give a new impulse to the military service, had ordered a grand review ; and the battalion of Turmero, in a mock fight, had fired on that of La Victoria. Our host, a lieutenant of the militia, was never weary of describing to us the danger of these mancuurres, which seemed more burlesque than imposing. With what rapidity do nations, apparently the most pacific, acquire military habits! Twelve years afterwards, those valleys of Aragua, those peaceful plains of La Victoria and Turmero, the defile of Cabrera, and the fertile banks of the lake of Valencia, became the scenes of obstinate and sanguinary conflicts between the natives and the troops of the mother-country.

South of Turmero, a mass of limestone mountains advances into the plain, separating two fine sugar-plantations, Guayarita and Paja. The latter belongs to the family of Count Tovar, who have property in every part of thes province. Near Guayavita, brown iron-ore has been discovered. To the north of Turmero, a granitic summit (the Chuas) rises in the Cordillera of the coast, from the top of which we discern at once the sea and the lake of Valencia. Crossing this rocky ridge, which runs towards the west farther than the eye can reach, paths somewhat difficult lead to the rich plantations of cacao on the coast, to Choroni, Turiamo, and Ocumare, noted alike for the fertility of the soil and the insalubrity of their climate. Turmero, Maracay, Cura, Guacara, every point of the valley of Aragua, has its mountain-road, which terminates at one of the small ports on the coast.

On quitting the village of Turmero, we discover, at a league distant, an object, which appears at the horizon like a round hillock, or tumulus, covered with vegetation. It is neither a hill, nor a group of trees close to each other, but one single tree, the famous zamang del Guayre, known throughout the province for the enormous extent of its branches, which form a hemispheric head five hundred and seventy-six feet in circumference. The zamang is a fine species of mimosa, and its tortuous branches are divided by
bifureation. Its delicate and tender foliage was agreeably relieved on the azure of the sky. We stopped a long time under this vegetable roof. The trunk of the zamang del Guayre,* which is found on the road from Turmero to Maracay, is only sixty feet high, and nine thiek; but its real beauty consists in the form of its head. The branches extend like an immense umbrella, and bend toward the ground, from which they remain at a uniform distance of twelve or fifteen feet. The circumference of this head is so regular, that, having traced different diameters, I found them one hundred and ninety-two and one hundred and eighty-six feet. One side of the tree was entirely stripped of its foliage, owing to the drought; but on the other side there remained both leaves and flowers. Tillandsias, loranthea, Cactus Pitahaya, and other parasite plants, cover its branches, and crack the bark. The inhabitants of these villages, but particularly the Indians, hold in veneration the zamang del Guayre, which the first conquerors found almost in the same state in which it now remains. Since it has been obseryed with attention, no change has appeared in its thickness or height. This zamang must be at least as old as the Orotava dragon-tree. There is something solemn and majestic in the aspect of aged trees; and the violation of these monuments of nature is severely punished in countries destitute of monuments of art. We heard with satisfaction that the present proprietor of the zamang had brought an action against a cultivator who had been guilty of cutting off a branch. The cause was tried, and the tribunal condemned the offender. We find near Turmero and the Hacienda de Cura other zamangs, having trunks larger than that of Guayre, but their hemispherical heads are not of equal extent.

The culture and population of the plains augment in the direction of Cura and Guacara, on the northern side of the lake. The valleys of Aragua contain more than 52,000 inhabitants, on a space thirteen leagues in length, and two in width. This is a relative population of two thousand souls on a square league. The village, or rather the small

[^175]town of Maracay was heretofore the centre of the indigo plantations, when this branch of colonial industry was in its greatest prosperity. The houses are all of masonry, and every court contains cocoa-trees, which rise above the habitations. The aspect of general wealth is still more striking at Maracay, than at Turmero. The anil, or indigo, of these provinces has always been considered in commerce as equal and sometimes superior to that of Guatemala. The indig, plant impoverishes the soil, where it is cultivated during a long series of years, more than any other. The lands of Maracay, Tapatapa, and Turmero, are looked upon as erhausted; and indeed the produce of indigo has been constantly decreasing. But in proportion as it has diminished in the valleys of Aragua, it has increased in the province of Varinas, and in the burning plains of Cucuta, where, on the banks of the Rio Tachira, virgin land yields an abundant produce, of the richest colour.

We arrived very late at Maracay, and the persons to whom we were recommended were absent. The inhabitants perceiving our embarrassmeut, contended with each other in offering to lodge us, to place our instruments, and take care of our mules. It has been said a thousand times, bus the traveller always feels desirous of repeating it again, that the Spanish colonies are the land of hospitality; they are so even in those places where industry and commerce have diffused wealth and improvement. A family of Canarians received us with the most amiable cordiality; an excellent repast was prepared, and everything was carefully aroided that might act as any restraint on us. The master of the house, Don Alexandro Gonzales, was travelling on commercial business, and his young wife had lately had the happiness of becoming a mother. She was transported with joy when she heard that on our return from the Rio Negro we should proceed by the banks of the Orinoco to Angostura, where her husband was. We were to bear to him the tidings of the birth of his first child. In those countries, as among the ancients, travellers are regarded as the safest means of communication. There are indeed posts established, but they make such great circuits that private persons seldom entrust them with letters for the llanos or savannahs of the interior. The child was brought to us at the moment
of our departure: we had seen him asleep at night, but it was deemed indispensable that we should see him awake in the morning. We promised to describe his features exactly to his father, but the sight of our books and instruments somewhat chilled the mother's confidence. She said "that in a long journey, amidst so many cares of another kind, we might well forget the colour of her child's eyes."

On the road from Maracay to the Hacienda de Cura we enjoyed from time to time the view of the lake of Valencia. An arm of the granitic chain of the coast stretches southward into the plain. It is the promontory of Portachuelo which would almost close the valley, were it not separated by a narrow defile from the rock of La Cabrera. This place has acquired a sad celebrity in the late revolutionary wars of Caracas ; each party having obstinately disputed its possession, as opening the way to Valencia, and to the Llanos. La Cabrera now forms a peninsula: not sixty years ago it was a rocky island in the lake, the waters of which gradually diminish. We spent seven very agreeable days at the Hacienda da Cura, in a small habitation surrounded by thickets.

We lived after the manner of the rich in this country; we bathed twice, slept three times, and made three meals in the twenty-four hours. The temperature of the water of the lake is rather warm, being from twenty-four to twenty-five degrees; but there is another cool and delicious dathing-place at Toma, under the shade of ceibas and large zamangs, in a torrent gushing from the granitic mountains of the Rincon del Diablo. In entering this bath, we had not to fear the sting of insects, but to guard against the little brown hairs which cover the pods of the Dolichos pruriens. When these small hairs, well characterised by the name of picapica, stick to the body, they excite a violent irritation on the skin; the dart is felt, but the cause is unperceived.

Near Cura we found all the people occupied in clearing the ground covered with mimosa, sterculia, and Coccoloba excoriata, for the purpose of extending the cultivation of cotton. This product, which partly supplies the place of indigo, has succeeded so well during some years, that the cotton-tree now grows wild on the borders of the lake of

Valencia. We have found shrubs of eight or ten feet high entwined with bignonia and other ligneous creepers. The exportation of cotton from Caracas, however, is yet of small importance. It amounted at an average at La Guayra scarcely to three or four hundred thousand pounds in a year; but including all the ports of the Capitania-general, it arose, on account of the flourishing culture of Cariaco, Nueva Barcelona, and Maracaybo, to more than 22,000 quintals. The cotton of the valleys of Aragua is of fine quality, being inferior only to that of Brazil ; for it is preferred to that of Carthagena, St. Domingo, and the Caribbee Islands. The cultivation of cotton extends on one side of the lake from Maracay to Valencia; and on the other from Guayca to Guigue. The large plantations yield from sixty to seventy thousand pounds a year.

During our stay at Cura we made numerous excursions to the rocky islands (which rise in the midst of the lake of Valencia, ) to the warm springs of Mariara, and to the lofty granitic mountain called El Cucurucho de Coco. A dangerous and narrow path leads to the port of Turiamo and the celebrated cacao-plantations of the coast. In all these excursions we were agreeably surprised, not only at the progress of agriculture, but at the increase of a free laborions population, accustomed to toil, and too poor to rely on the assistance of slaves. White and mulatto farmers had everywhere small separate establishments. Our host, whose father had a revenue of 40,000 piastres, possessed more lands than he could clear $; \cdot$ he distributed them in the valleys of Aragua among poor families who chose to apply themselves to the cultivation of cotton. He endeavoured to surround his ample plantations with freemen, who, working as they chose, either in their own land or in the neighbouring plantations, supplied him with day-labourers at the time of harvest. Nobly occupied on the means best adapted gradually to extinguish the slavery of the blacks in these provinces, Count Tovar flattered himself with the double hope of rendering slaves less necessary to the landholders, and furnishing the freedmen with opportunities of becoming farmers. On departing for Europe he had parcelled out and let a part of the lands of Cura, which extend towards the west at the foot of the rock of Las Viruelas.'

Four years after, at his return to America, he found on this spot, finely cultivated in cotton, a little hamlet of thirty or forty houses, which is called Punta Zamuro, and which we visited with him. The inhabitants of this hamlet are almost all mulattos, Zamboes, or free blacks. This example of letting out land has been happily followed by several other great proprietors. The rent is ten piastres for a fanega of ground, and is paid in money or in cotton. As the small farmers are often in want, they sell their cotton at a very moderate price. They dispose of it even before the harvest; and the advances, made by rich neighbours, place the debtor in a situation of dependence, which frequently obliges him to offer his services as a labourer. The price of labour is cheaper here than in France. A freeman, working as a day-labourer (peon), is paid in the valleys of Aragua and in the llanos four or five piastres per month, not including food, which is very cheap on account of the abundance of meat and vegetables. I love to dwell on these details of colonial industry, because they serve to prove to the inhabitants of Europe, a fact which to the enlightened inhabitants of the colonies has long ceased to be doubtful, viz., that the continent of Spanish America can produce sugar, cotton, and indigo by free hands, and that the unhappy slaves are capable of becoming peasants, farmers, and landholders.

# PRINTED BY HARRISON AND SONS, LONDOK GAZETTE OFHICE, GT. MARTIN'S LANR. 

PERSONAL NARRATIVE of

# EQUINOCTIAL REGIONS OF AMERICA, 

 DURING THE YEARS 1799-1804.BY ALEXANDER VON HUMBOLDT AND AIME BONPLAND.

WBITTEN IN FBENCH BY
ALEXANDER VON HUMBOLDT:
translated and edited by thomasina ross.

> IN THREE VOLUMES.

VOL. II.

## LONDON:

HENRY G. BOHN, YORK STREET, COVENT GARDEN. 1852.

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# PERSONAL NARRATIVE 

OF A

# JOURNEY <br> TO THK <br> EQUINOCTIAL REGIONS <br> or <br> <br> THE NEW CONTINENT. 

 <br> <br> THE NEW CONTINENT.}

## Chapter XVI.

Lake of Tacarigua.-Hot Springs of Mariara.-Town of Nueva Valencia del Rey.-Descent towards the Coasts of Porto Cabello.

The valleys of Aragua form a narrow basin between granitic and calcareous mountains of unequal height. On the north, they are separated by the Sierra Mariara from the sea-coast; and towards the south, the chain of Guacimo and Yusma serves them as a rampart against the heated air of the steppes. Groups of hills, high enough to determine the course of the waters, close this basin on the east and west like transverse dykes. We find these hills between the Tuy and La Victoria, as well as on the road from Valencia to Nirgua, and at the mountains of Torito.* From

* The lofty mountains of Los Teques, where the Tay takes its source, may be looked upon as the eastern boundary of the valleys of Aragua. The level of the ground continues, in fact, to rise from La Victoria to the Hacienda de Tuy; but the river Tuy, turning southward in the direction of the sierras of Guairaima and Tiara, has found an issue on the east;

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this extraordinary configuration of the land, the little rivers of the valleys of Aragua form a peculiar system, and direct their course towards a basin closed on all sides. These rivers do not bear their waters to the ocean; they are collected in a lake; and subject to the peculiar influence of evaporation, they lose themselves, if we may use the expression, in the atmosphere. On the existence of rivers and lakes, the fertility of the soil and the produce of cultivation in these valleys depend. The aspect of the spot, and the experience of half a century, have proved that the level of the waters is not invariable; the waste by evaporation, and the increase from the waters running into the lake, do not uninterruptedly balance each other. The lake being elevated one thousand feet above the neighbouring steppes of Calabozo, and one thousand three hundred and thirty-two feet above the level of the ocean, it has been suspected that there are subterranean communications and filtrations. The appearance of new islands, and the gradual retreat of the waters, have led to the belief that the lake may perhaps, in time, become entirely dry. An assemblage of physical circumstances so remarkable was well fitted to fix my attention on those valleys where the wild beauty of nature is embellished by agricultural industry, and the arts of rising civilization.

The lake of Valencia, called Tacarigua by the Indians, exceeds in magnitude the lake of Neufchatel in Switzerland; but its general form has more resemblance to the lake of Geneva, which is nearly at the same height above the level of the sea. As the slope of the ground in the valleys of Aragua tends towards the south and the west, that part of the basin still covered with water is the nearest to the southern chain of the mountains of Guigue, of Yusma, and of Guacimo, which stretch towards the high savannahs of Ocumare. The opposite banks of the lake of Valencia display a singular contrast ; those on the south are desert, and almost uninhabited, and a screen of high mountains

[^176]gives them a gloomy and monotonous aspect. The northern shore on the contrary, is cheerful, pastoral, and decked with the rich cultivation of the sugar-cane, coffee-tree, and cotton. Paths bordered with cestrums, azedaracs, and other shrubs always in flower, cross the plain, and join the scattered farms. Every house is surrounded by clumps of trees. The ceiba with its large yellow flowers* gives a peculiar character to the landscape, mingling its branches with those of the purple erythrina. This mixture of vivid vegetable colours contrasts finely with the uniform tint of an unclouded sky. In the season of drought, where the burning soil is covered with an undulating vapour, artificial irrigations preserve verdure and promote fertility. Here and there the granite rock pierces through the cultivated ground. Enormous stony masses rise abruptly in the midst of the valley. Bare and forked, they nourish a few succulent plants, which prepare mould for future ages. Often on the summit of these lonely hills may be seen a fig-tree or a clusia with fleshy leaves, which has fixed its roots in the rock, and towers over the landscape. With their dead and withered branches, these trees look like signals erected on a steep cliff. The form of these mounts unfolds the secret of their ancient origin; for when the whole of this valley was filled with water, and the waves beat at the foot of the peaks of Mariara (the Devil's Nook) $\dagger$ and the chain of the coast, these rocky hills were shoals or islets.

These features of a rich landscape, these contrasts between the two banks of the lake of Valencia, often reminded me of the Pays de Vaud, where the soil, everywhere cultivated, and everywhere fertile, offers the husbandman, the shepherd, and the vine-dresser, the secure fruit of their labours, while, on the opposite side, Chablais presents only a mountainous and half-desert country. In these distant climes surrounded by exotic productions, I loved to recall to mind the enchanting descriptions with which the aspect of the Leman lake and the rocks of La Meillerie inspired a great writer. Now, while in the centre of civilized Europe, I endeavour in my turn to paint the scenes of the New World, I do not imagine I present the reader with clearer

* Carmes tollendas (Bombax hibiscifolius).
$\dagger$ El Rincon del Diablo.
images, or more precise ideas, by comparing our landscapes with those of the equinoctial regions. It cannot be too often repeated that nature, in every zone, whether wild or cultivated, smiling or majestic, has an individual character. The impressions which she excites are infinitely varied, like the emotions produced by works of genius, according to the age in which they were conceived, and the diversity of language from which they in part derive their charm. We must limit our comparisons merely to dimensions and external form. We may institute a parallel between the colossal summit of Mont Blanc and the Himalaya Mountains; the cascades of the Pyrenees and those of the Cordilleras : but these comparisons, useful with respect to science, fail to convey an idea of the characteristics of nature in the temperate and torrid zones. On the banks of a lake, in a vast forest, at the foot of summits covered with eternal snow, it is not the mere magnitude of the objects which excites our admiration. That which speaks to the soul, which causes such profound and varied emotions, escapes our measurements as it does the forms of language. Those who feel powerfully the charms of nature cannot venture on comparing one with another, scenes totally different in character.

But it is not alone the picturesque beauties of the lake of Valencia that have given celebrity to its banks. This basin presents several other phenomena, and suggests questions, the solution of which is interesting alike to physical science and to the well-being of the inhabitants. What are the causes of the diminution of the waters of the lake? Is this diminution more rapid now than in former ages? Can we presume that an equilibrium between the waters flowing in and the waters lost will be shortly re-established, or may we apprehend that the lake will entirely disappear?

According to astronomical observations made at La Victoria, Hacienda de Cura, Nueva Valencia, and Guigue, the length of the lake in its' present state from Cagua to Guayos, is ten leagues, or twenty-eight thousand eight hundred toises. Its breadth is very unequal. If we judge from the latitudes of the mouth of the Rio Cura and the village of Guigue, it nowhere surpasses 2.3 leagues, or six thousand five hundred toises; most commonly it is but four
or five miles. The dimensions, as deduced from my observations are much less than those hitherto adopted by the natives. It might be thought that, to form a precise idea of the progressive diminution of the waters, it would be sufficient to compare the present dimensions of the lake with those attributed to it by ancient chroniclers; by Oviedo for instance, in his History of the Province of Venezuela, published about the year 1723. This writer in his emphatic style, assigns to "this inland sea, this monstruoso cuerpo de la laguna de Valencia,"* fourteen leagues in length and six in breadth. He affirms that at a small distance from the shore the lead finds no bottom; and that large Hoating islands cover the surface of the waters, which are constantly agitated by the winds. No importance can be attached to estimates which, without being founded on any measurement, are expressed in leagues (leguas) reckoned in the colonies at three thousand, five thousand, and six thousand six hundred and fifty varas. $\dagger$ Oviedo, who must so often have passed over the valleys of Aragua, asserts that the town of Nueva Valencia del Rey was built in 1555, at the distance of half a league from the lake; and that the proportion between the length of the lake and its breadth, is as seven to three. At present, the town of Valencia is separated from the lake by level ground of more than two thousand seven hundred toises (which Oviedo would no doubt have estimated as a space of a league and a half) ; and the length of the basin of the lake is to its breadth as 10 to $2 \cdot 3$, or as 7 to 1.6 . The appearance of the

\author{

* "Enormous body of the lake of Valencia."
}
$\dagger$ Seamen being the first, and for a long time the only, persons who introduced into the Spanish colonies any precise ideas on the astronomical position and distances of places, the legua nautica of 6650 varas, or of 2854 toises ( 20 in a degree), was originally used in Mexico and throughout .South America; but this legua nautica has been gradually reduced to one-half or one-third, on account of the slowness of travelling across steep mountains, or dry and burning plains. The common people measure only time directly ; and then, by arbitrary hypotheses, infer from the time the space of ground travelled over. In the course of my geographical researches, I have had frequent opportunities of examining the real value of these leagues, by comparing the itinerary distances between points lying under the same meridian with the difference of latitudes.
soil between Valencia and Guigue, the little hills rising abruptly in the plain east of the Caño de Cambury, some of which (el Islote and la Isla de la Negra or Caratapona) have even preserved the name of islands, sufficiently prove that the waters have retired considerably since the time of Oviedo. With respect to the change in the general form of the lake, it appears to me improbable that in the seventeenth century its breadth was nearly the half of its length. The situation of the granite mountains of Mariara and of Guigue, the slope of the ground which rises more rapidly towards the north and south than towards the east and west, are alike repugnant to this supposition.

In treating the long-discussed question of the diminution of the waters, I conceive we must distinguish between the different periods at which the sinking of their level has taken place. Wherever we examine the valleys of rivers, or the basins of lakes, we see the ancient shore at great distances. No doubt seems now to be entertained, that our rivers and lakes have undergone immense diminutions; but many geological facts remind us also, that these great changes in the distribution of the waters have preceded all historical times; and that for many thousand years most lakes have attained a permanent equilibrium between the produce of the water flowing in, and that of evaporation and filtration. Whenever we find this equilibrium broken, it will be well rather to examine whether the rupture be not owing to causes merely local, and of very recent date, than to admit an uninterrupted diminution of the water. This reasoning is conformable to the more circumspect method of modern science. At a time when the physical history of the world, traced by the genius of some eloquent writers, borrowed all its charms from the fictions of imagination, the phenomenon of which we are treating would have been adduced as a new proof of the contrast these writers sought to establish between the two continents. To demonstrate that America rose later than Asia and Europe from the bosom of the waters, the lake of Tacarigua would have been described as one of those interior basins which have not yet become dry by the effects of slow and gradual evaporation. I have no doubt that, in very remote times, the whole valley, from the foot of the mountains of

Cocuyza to those of Torito and Nirgua, and from La Sierra de Mariara to the chain of Guigue, of Guacimo, and La Palma, was filled with water. Everywhere the form of the promontories, and their steep declivities, seem to indicate the shore of an alpine lake, similar to those of Styria and Tyrol. The same little helicites, the same valvatæ, which nuw live in the lake of Valencia, are found in layers of three or four feet thick as far inland as Turmero and La Concesion near La Victoria. These facts undoubtedly prove a retreat of the waters; but nothing indicates that this retreat has continued from a very remote period to our days. The valleys of Aragua sea among the portions of Venezuela most anciently peopled; and yet there is no mention in Oviedo, or any other old chronicler, of a sensible diminution of the lake. Must we suppose, that this phenomenon escaped their observation, at a time when the Indians far exceeded the white population, and when the banks of the lake were less inhabited? Within half a century, and particularly within these thirty years, the natural desiccation of this great basin has excited general attention. We find vast tracts of land which were formerly inundated, now dry, and already cultivated with plantains, sugar-canes, or cotton. Wherever a hut is erected on the bank of the lake, we see the shore receding from year to year. We discover islands, which, in consequence of the retreat of the waters, are just beginning to be joined to the continent, as for instance the rocky island of Culebra, in the direction of Guigue; other islands already form promontories, as the Morro, between Guigue and Nueva Valencia, and La Cabrera, south-east of Mariara; others again are now rising in the islands themselves like scattered hills. Among these last, so easily recognized at a distance, some are only a quarter of a mile, others a league from the present shore. I may cite as the most remarkable three granite islands, thirty or forty toises high, on the road from the Hacienda de Cura to Aguas Calientes; and at the western extremity of the lake, the Serrito de Don Pedro, Islote, and Caratapona. On visiting two islands* entirely surrounded by water, we found in the

[^177]midst of brushwood, on small flats (four, six, and even eight toises height above the surface of the lake, fine sand mixed with helicites, anciently deposited by the waters. In each of these islands may be perceived the most certain traces of the gradual sinking of the waters. But still farther (and this accident is regarded by the inhabitants as a marvellous phenomenon) in 1796 three new islands appeared to the east of the island Caiguira, in the same direction as the islands Burro, Otama, and Zorro. These new islands, called by the people Los nuevos Peñones, or Los Aparecidos,* form a kind of banks with surfaces quite flat. They rose, in 1800, more than a foot above the mean level of the rater.

It has already been observed that the lake of Valencia, like the lakes of the valley of Mexico, forms the centre of a little system of rivers, none of which have any communication with the ocean. These rivers, most of which deserve only the name of torrents, or brooks, $\dagger$ are twelve or fourteen in number. The inhabitants, little acquainted with the effects of evaporation, have long imagined that the lake has a subterranean outlet, by which a quantity of water runs out equal to that which flows in by the rivers. Some suppose that this outlet communicates with grottos, supposed to be at great depth; others believe that the water flows through an oblique channel into the basin of the ocean. These bold hypotheses on the communication between two neighbouring basins have presented themselves in every zone to the imagination of the ignorant, as well as to that of the learned; for the latter, without confessing it, sometimes repeat popular opinions in scientific language. We hear of subterranean gulfs and outlets in the New World, as on the shores of the Caspian sea, though the lake of Tacarigua is two hundred and twenty-two toises higher, and the Caspian sea fifty-four toises lower, than the sea; and though it is well known, that fluids find the same level, when they communicate by a lateral channel.

[^178]The changes which the destruction of forests, the clearing of plains, and the cultivation of indigo, have produced within half a century in the quantity of water flowing in on the one hand, and on the other the evaporation of the soil, and the dryness of the atmosphere, present causes sufficiently powerful to explain the progressive diminution of the lake of Valencia. I cannot concur in the opinion of M . Depons* (who visited these countries since I was there) "that to set the mind at rest, and for the honour of science," a subterranean issue must be admitted. By felling the trees which cover the tops and the sides of mountains, men in every climate prepare at once two calamities for future generations; want of fuel and scarcity of water. Trees, by the nature of their perspiration, and the radiation from their leaves in a sky without clouds, surround themselves with an atmosphere constantly cold and misty. They affect the copiousness of springs, not, as was long believed, by a peculiar attraction for the vapours diffused through the air, but because, by sheltering the soil from the direct action of the sun, they diminish the evaporation of water produced by rain. When forests are destroyed, as they are everywhere in America by the European planters, with imprudent precipitancy, the springs are entirely dried up, or become less abundant. The beds of the rivers, remaining dry during a part of the year, are converted into torrents whenever great rains fall on the heights. As the sward and moss disappear with the brushwood from the sides of the mountains, the waters falling in rain are no longer impeded in their course; and instead of slowly augmenting the level of the rivers by progressive filtrations, they furrow, during heary showers, the sides of the hills, bearing down the loosened soil, and forming sudden and destructive inundations. Hence it results, that the clearing of forests, the want of permanent springs, and the existence of torrents, are three phenomena closely connected together. Countries

[^179]situated in opposite hemispheres, as, for example, Lombardy bordered by the Alps, and Lower Peru inclosed between the Pacific and the Cordillera of the Andes, afford striking proofs of the justness of this assertion.

Till the middle of the last century, the mountains round the valleys of Aragua were covered with forests. Great trees of the families of mimosa, ceiba, and the fig-tree, shaded and spread coolness along the banks of the lake. The plain, then thinly inhabited, was filled with brushwood, interspersed with trunks of scattered trees and parasite plants, enveloped with a thick sward, less capable of emitting radiant caloric than the soil that is cultivated and consequently not sheltered from the rays of the sun. With the destruction of the trees, and the increase of the cultivation of sugar, indigo, and c.tton, the springs, and all the natural supplies of the lake of Valencia, have diminished from year to year. It is difficult to form a just idea of the enormous quantity of evaporation which takes place under the torrid zone, in a valley surrounded with steep declivities, where a regular breeze and descending currents of air are felt towards evening, and the bottom of which is flat, and looks as if levelled by the waters. It has been remarked, that the heat which prevails throughout the year at Cura, Guacara, Nueva Valencia, and on the borders of the lake, is the same as that felt at midsummer in Naples and Sicily. The mean annual temperature of the valleys of Aragua is nearly $25 \cdot 5^{\circ}$; my hygrometrical observations of the month of February, taking the mean of day and night, gave $71.4^{\circ}$ of the hair hygrometer. As the words great drought and great humidity have no determinate signification, and air that would be called very dry in the lower regions of the tropics would be regarded as humid in Europe, we can judge of these relations between climates only by comparing spots situated in the same zone. Now at Cumana, where it sometimes does not rain during a whole year, and where I had the means of collecting a great number of hygrometric observations made at different hours of the day and night, the mean humidity of the air is $86^{\circ}$; corresponding to the mean temperature of $27.7^{\circ}$, Taking into account the influence of the rainy months, that is to say, estimating the difference observed in other parts
of South America between the mean humidity of the dry months and that of the whole year ; an annual mean humidity is obtained, for the valleys of Aragua, at farthest of $74^{\circ}$, the temperature being $25.5^{\circ}$. In this air, so hot, and at the same time so little humid, the quantity of water evaporated is enormous. The theory of Dalton estimates, under the conditions just stated, for the thickness of the sheet of Water evaporated in an hour's time, 0.36 mill., or 3.8 lines in twenty-four hours. Assuming for the temperate zone, for instance at Paris, the mean temperature to be $10.6^{\circ}$, and the mean humidity $82^{\circ}$, we find, according to the same formulx, 0.10 mill. an hour, and 1 line for twenty-four hours. If we prefer substituting for the uncertainty of these theoretical deductions the direct results of observation, we may recollect that in Paris, and at Montmorency, the mean annual evaporation was found by Sedileau and Cotte, to be from 32 in .1 line to 38 in .4 lines. Two able engineers in the south of France, Messrs. Clausade and Pin, found, that in subtracting the effects of filtrations, the waters of the canal of Languedoc, and the basin of Saint Ferréol lose every year from 0.758 met. to 0.812 met., or from 336 to 360 lines. M. de Prony found nearly similar results in the Pontine marshes. The whole of these experiments, made in the latitudes of $41^{\circ}$ and $49^{\circ}$, and at $10.5^{\circ}$ and $16^{\circ}$ of mean temperature, indicate a mean evaporation of one line, or one and three-tenths a day. In the torrid zone, in the West India Islands for instance, the effect of evaporation is three times as much, according to Le Gaux, and double according to Cassan. At Cumana, in a place where the atmosphere is far more loaded with humidity than in the valley of Aragua, I have often seen evaporate during twelve hours, in the sun, 8.8 mill., in the shade 3.4 mill.; and I believe, that the annual produce of evaporation in the rivers near Cumana is not less than one hundred and thirty inches. Experiments of this kind are extremely delicate, but what I have stated will suffice to demonstrate how great must be the quantity of vapour that rises from the lake of Valencia, and from the surrounding country, the waters of which flow into the lake. I shall have occasion elsewhere to resume this subject; for, in a work which displays the great laws of nature in different
zones, we must endeavour to solve the problem of the mean tension of the vapours contained in the atmosphere in different latitudes, and at different heights above the surface of the ocean.

A great number of local circumstances cause the produce of evaporation to vary; it changes in proportion as more or less shade covers the basin of the waters, with their state of motion or repose, with their depth, and the nature and colour of their bottom; but in general evaporation depends only on three circumstances, the temperature, the tension of the vapours contained in the atmosphere, and the resistance which the air, more or less dense, more or less agitated, opposes to the diffusion of vapour. The quantity of water that evaporates in a given spot, everything else being equal, is proportionate to the difference between the quantity of vapour which the ambient air can contain when saturated, and the quantity which it actually contains. Hence it follows that the evaporation is not so great in the torrid zone as might be expected from the enormous augmentation of temperature; because, in those ardent climates, the air is habitually very humid.

Since the increase of agricultural industry in the valleys of Aragua, the little rivers which run into the lake of Valencia can no longer be regarded as positive supplies during the six months succeeding December. They remain dried up in the lower part of their course, because the planters of indigo, coffee, and sugar-canes, have made frequent drainings (azequias), in order to water the ground by trenches. We may observe also, that a pretty considerable river, the Rio Pao, which rises at the entrance of the Llanos, at the foot of the range of hills called La Galera, heretofore mingled its waters with those of the lake, by uniting with the Caño de Cambury, on the road from the town of Nueva Valencia to Guigue. The course of this river was from south to north. At the end of the seventeenth century, the proprietor of a neighbouring plantation dug at the back of the hill a new bed for the Rio Pao. He turned the river; and, after having employed part of the water for the irrigation of his fields, he caused the rest to flow at a venture southward, following the declivity of the Llanos. In this new southern direction the Rio Pao, mingled with three other rivers, the

Tinaco, the Guanarito, and the Chilua, falls into the Portuguesa, which is a branch of the Apure. It is a remarkable phenomenon, that by a particular position of the ground, and the lowering of the ridge of division to south-west, the Rio Pao separates itself from the little system of interior rivers to which it originally belonged, and for a century past has communicated, through the channel of the Apure and the Orinoco, with the ocean. What has been here effected on a small scale by the hand of man, nature often performs, either by progressively elevating the level of the soil, or by those falls of the ground occasioned by violent earthquakes. It is probable, that in the lapse of ages, several rivers of Soudan, and of New Holland, which are now lost in the sands, or in inland basins, will open for themselves a course to the shores of the ocean. We cannot at least doubt, that in both continents there are systems of interior rivers, which may be considered as not entirely developed; and which communicate with each other, either in the time of great risings, or by permanent bifurcations.

The Rio Pao has scooped itself out a bed so deep and broad, that in the season of rains, when the Caño Grande de Cambury inundates all the land to the north-west of Guigue, the waters of this Caño, and those of the lake of Valencia, flow back into the Rio Pao itself; so that this river, instead of adding water to the lake, tends rather to carry it away. We see something similar in North America, where geographers have represented on their maps an imaginary chain of mountains, between the great lakes of Canada and the country of the Miamis. At the time of floods, the waters flowing into the lakes communicate with those which run into the Mississippi; and it is practicable to proceed by boats from the sources of the river St. Mary to the Wabash, as well as from the Chicago to the Illinois. These analogous facts appear to me well worthy of the attention of hydrographers.

The land that surrounds the lake of Valencia being entirely flat and even, a diminution of a few inches in the level of the water exposes to view a vast extent of ground covered with fertile mud and organic remains.* In proportion as the lake retires, cultivation advances towards the new shore.

* This I observed daily in the Lake of Mexico.

These natural desiccations, so important to agriculture, have been considerable during the last ten years, in which America has suffered from great droughts. Instead of marking the sinuosities of the present banks of the lake, I have advised the rich landholders in these countries to fix columns of granite in the basin itself, in order to observe from year to year the mean height of the waters. The Marquis del Toro has undertaken to put this design into execution, employing the fine granite of the Sierra de Mariara, and establishing limnometers, on a bottom of gneiss rock, so common in the lake of Valencia.

It is impossible to anticipate the limits, more or less narrow, to which this basin of water will one day be confined, when an equilibrium between the streams flowing in and the produce of evaporation and filtration, shall be completely established. The idea very generally spread, that the lake will soon entirely disappear, seems to me chimerical. If in consequence of great earthquakes, or other causes equally mysterious, ten very humid years should succeed to long droughts; if the mountains should again become clothed with forests, and great trees overshadow the shore and the plains of Aragua, we should more probably see the volume of the waters augment, and menace that beautiful cultivation which now trenches on the basin of the lake.

While some of the cultivators of the valleys of Aragua fear the total disappearance of the lake, and others its return to the banks it has deserted, we hear the question gravely discussed at Caracas, whether it would not be advisable, in order to give greater extent to agriculture, to conduct the waters of the lake into the Llanos, by digging a canal towards the Rio Pao. The possibility" of this enter-

[^180]prise cannot be denied, particularly by having recourse to tunnels, or subterranean canals. The progressive retreat of the waters has given birth to the beautiful and luxuriant plains of Maracay, Cura, Mocundo, Guigue, and Santa Cruz del Escoval, planted with tobacco, sugar-canes, coffee, indigo, and cacao ; but how can it be doubted for a moment that the lake alone spreads fertility over this country? If deprived of the enormous mass of vapour which the surface of the waters sends forth daily into the atmosphere, the valleys of Aragua would become as dry and barren as the surrounding mountains.
The mean depth of the lake is from twelve to fifteen fathoms; the deepest parts are not, as is generally admitted, eighty, but thirty-five or forty deep. Such is the result of soundings made with the greatest care by Don Antonio Manzano. When we reflect on the vast depths of all the lakes of Switzerland, which, notwithstanding their position in high valleys, almost reach the level of the Mediterranean, it appears surprising that greater cavities are not found at the bottom of the lake of Valencia, which is also an Alpine lake. The deepest places are between the rocky island of Burro and the point of Caña Fistula, and opposite the high mountains of Mariara. But in general the southern part of the lake is deeper than the northern : nor must we forget that, if all the shores be now low, the southern part of the basin is the nearest to a chain of mountains with abrupt declivities; and we know that even the sea is generally deepest where the coast is elevated, rocky, or perpendicular.
The temperature of the lake at the surface during my abode in the valleys of Aragua, in the month of February, was constantly from $23^{\circ}$ to $23 \cdot 7^{\circ}$, consequently a little below the mean temperature of the air. This may be from the effect of evaporation, which carries off caloric from the air and the water; or because a great mass of water does not follow with an equal rapidity the changes in the tempera-

[^181]ture of the atmosphere, and the lake receives streams whica rise from several cold springs in the neighbouring mountains. I have to regret that, notwithstanding its small depth, I could not determine the temperature of the water at thirty or forty fathoms. I was not provided with the thermometrical sounding apparatus which I had used in the Alpine lakes. of Salzburg, and in the Caribbean Sea. The experiments of Saussure prove that, on both sides of the Alps, the lakes which are from one hundred and ninety to two hundred and seventy-four toises of absolute elevation* have, in the middle of winter, at nine hundred, at six hundred, and sometimes even at one hundred and fifty feet of depth, a uniform temperature from $4: 3$ to 6 degrees: but these experiments have not yet been repeated in lakes situated under the torrid zone. The strata of cold water in Switzerland are of an enormous thickness. They have been found so near the surface in the lakes of Geneva and Bienne, that the decrement of heat in the water was one centesimal degree for ten or fifteen feet; that is to say, eight times more rapid than in the ocean, and forty-eight times more rapid than in the atmosphere. In the temperate zone, where the heat of the atmosphere sinks to the freezing point, and far lower; the bottom of a lake, even were it not surrounded by glaciers and mountains covered with eternal snow, must contain particles of water which, having during winter acquired at the surface the maximum of their density, between $3.4^{\circ}$ and $4.4^{\circ}$, have consequently fallen to the greatest depth. Other particles, the temperature of which is $+0.5^{\circ}$, far from placing themselves below the stratum at $4^{\circ}$, can only find their hydrostatic equilibrium above that stratum. They will descend lower only when their temperature is augmented $3^{\circ}$ or $4^{\circ}$ by the contact of strata less cold. If water in cooling continued to condense uniformly to the freezing point, there would be found, in very deep lakes and basins having no communication with each other (whatever the latitude of the place), a stratum of water, the temperature of which would be nearly equal to the maximum of refrigeration above the freezing point, which the lower regions of the ambient atmosphere annually attain.

[^182]Hence it is probable, that, in the plains of the torrid zone, or in the valleys but little elevated, the mean heat of which is from $25.5^{\circ}$ to $27^{\circ}$, the temperature of the bottom of the lakes can never be below $21^{\circ}$ or $22^{\circ}$. If in the same zone the ocean contain at depths of seven or eight hundred fathoms, water the temperature of which is at $7^{\circ}$, that is to say, twelve or thirteen degrees colder than the maximum of the heat* of the equinoctial atmosphere over the sea, I think it must be considered as a direct proof of a submarine current, carrying the waters of the pole towards the equator. We will not here solve the delicate problem, as to the manner in which, within the tropics and in the temperate zone, (for example, in the Caribbean Sea and in the lakes of Switzerland,) these inferior strata of water, cooled to $4^{\circ}$ or $7^{\circ}$, act upon the temperature of the stony strata of the globe which they cover; and how these same strata, the primitive temperature of which is, within the tropics, $27^{\circ}$, and at the lake of Geneva $10^{\circ}$, react upon the half-frozen waters at the bottom of the lakes, and of the equinoctial ocean. These questions are of the highest importance, both with regard to the economy of animals that live habitually at the bottom of fresh and salt waters, and to the theory of the distribution of heat in lands surrounded by vast and deep seas.
The lake of Valencia is full of islands, which embellish the scenery by the picturesque form of their rocks, and the beauty of the vegetation with which they are covered: an advantage which this tropical lake possesses over those of the Alps. The islands are fifteen in number, distributed in three groups; $\dagger$ without reckoning Morro and Cabrera, which are already joined to the shore. They are partly

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cultivated, and extremely fertile on account of the vapours that rise from the lake. Burro, the largest of these islands, is two miles in length, and is inhabited by some families of mestizos, who rear goats. These simple people seldom visit the shore of Mocundo. To them the lake appears of immense extent; they have plantains, cassava, milk, and a little fish. A hut constructed of reeds; hammocks woven from the cotton which the neighbouring fields produce; a large stone on which the fire is made; the ligneous fruit of the tutuma (the calabash) in which they draw water, constitute, their domestic establishment. An old mestizo who offered us some goat's milk had a beautiful daughter. We learned from our guide, that solitude had rendered him as mistrustful as he might perhaps have been made by the society of men. The day before our arrival, some hunters had visited the island. They were overtaken by the shades of night; and preferred sleeping in the open air to returning to Mocundo. This news spread alarm throughout the island. The father obliged the young girl to climb up a very lofty zamang or acacia, which grew in the plain at some distance from the hut, while he stretched himself at the foot of the tree, and did not permit his daughter to descend till the hunters had departed.

The lake is in general well stocked with fish; though it furnishes only three kinds, the flesh of which is soft and insipid, the guavina, the vagre, and the sardina. The two last descend into the lake with the streams that flow into it. The guavina, of which I made a drawing on the spot, is 20 inches long and 3.5 broad. It is perhaps a new species of the genus erythrina of Gronovius. It has large silvery scales edged with green. This fish is extremely voracious, and destroys other kinds. The fishermen assured us that a small crocodile, the bava,* which often approached us when we were bathing, contributes also to the destruction of the fish. We never could succeed in procuring this reptile so as to examine it closely: it generally

[^184]attains only three or four feet in length. It is said to be very harmless; its habits however, as well as its form, much resemble those of the alligator (Crocodilus acutus). It swims in such a manner as to show only the point of its snout, and the extremity of its tail; and places itself at mid-day on the bare beach. It is certainly neither a monitor (the real monitors living only in the old continent,) nor the sauvegarde of Seba (Lacerta teguixin,) which dives and does not swim. It is somewhat remarkable that the lake of Valencia, and the whole system of small rivers flowing into it, have no large alligators, though this dangerous animal abounds a few leagues off in the streams that flow either into the Apure or the Orinoco, or immediately into the Caribbean Sea between Porto Cabello and La Guayra.

In the islands that rise like bastions in the midst of the waters, and wherever the rocky bottom of the lake is visible, I recognised a uniform direction in the strata of gneiss. This direction is nearly that of the chains of mountains on the north and south of the lake. In the hills of Cabo Blanco there are found among the gneiss, angular masses of opaque quartz, slightly translucid on the edges, and varying from grey to deep black. This quartz passes sometimes into hornstein, and sometimes into kieselschiefer (schistose jasper). I do not think it constitutes a vein. The waters of the lake* decompose the gneiss by erosion in a very extraordinary manner. I have found parts of it porous, almost cellular, and split in the form of cauliflowers, fixed on gneiss perfectly compact. Perhaps the action ceases with the movement of the waves, and the alternate contact of air and water.

The island of Chamberg is remarkable for its height. It is a rock of gneiss, with two summits in the form of a saddle, and raised two hundred feet above the surface of the water. The slope of this rock is barren, and affords only nourishment for a few plants of clusia with large white

[^185]flowers. But the view of the lake and of the richly cultivated neighbouring valleys is beautiful, and their aspect is wonderful after sunset, when thousands of aquatic birds, herons, flamingoes, and wild ducks cross the lake to roost in the islands, and the broad zone of mountains which surrounds the horizon is covered with fire. The inhabitants, as we have already mentioned, burn the meadows in order to produce fresher and finer grass. Gramineous plants abound, especially at the summit of the chain; and those vast conflagrations extend sometimes the length of a thousand toises, and appear like streams of lava overflowing the ridge of the mountains. When reposing on the banks of the lake to enjoy the soft freshness of the air in one of those beautiful evenings peculiar to the tropics, it is delightful to contemplate in the waves as they beat the shore, the reflection of the red fires that illumine the horizon.

Among the plants which grow on the rocky islands of the lake of Valencia, many have been believed to be peculiar to those spots, because till now they have not been discovered elsewhere. Such are the papaw-trees of the lake; and the tomato* of the island of Cura. The latter differs from our Solanum lycopersicum; the fruit is round and small, but has a fine flavour ; it is now cultivated at La Victoria, at Nueva Valencia, and everywhere in the valleys of Aragua. The papaw-tree of the lake (papaya de la laguna) abounds also in the island of Cura and at Cabo Blanco ; its trunk shoots higher than that of the common papaw (Carica papaya), but its fruit is only half as large, perfectly spherical, without projecting ribs, and four or five inches in diameter. When cut open it is found quite filled with seeds, and without those hollow places which occur constantly in the common papaw. The taste of this fruit, of which I have often eaten, is extremely sweet. $\dagger$ I know not whether it be a variety of the Carica microcarpa, described by Jacquin.

The environs of the lake are insalubrious only in times of great drought, when the waters in their retreat leave a

[^186]muddy sediment exposed to the rays of the sun. The banks, shaded by tufts of Coccoloba barbadensis, and decorated with fine liliaceous plants,* remind us, by the appearance of the aquatic vegetation, of the marshy shores of our lakes in Europe. We find there, pondweed (potamogeton), chara, and cats'-tail three feet high, which it is difficult not to confound with the Typha angustifolia of our marshes. It is only after a careful examination, that we recognise each of these plants for distinct species, $\dagger$ peculiar to the new continent. How many plants of the Straits of Magellan, of Chile, and the Cordilleras of Quito have formerly been confounded with the productions of the northern temperate zone, owing to their analogy in form and appearance.
The inhabitants of the valleys of Aragua often inquire why the southern shore of the lake, particularly the southwest part towards los Aguacotis, is generally more shaded, and exhibits fresher verdure than the northern side. We saw, in the month of February, many trees stripped of their foliage, near the Hacienda de Cura, at Mocundo, and at Guacara; while to the south-east of Valencia everything presaged the approach of the rains. I believe that in the early part of the year, when the sun has southern declination, the hills around Valencia, Guacara, and Cura are scorched by the heat of the solar rays, while the southern shore receives, along with the breeze when it enters the valley by the Abra de Porto Cabello, an atmosphere which has crossed the lake, and is loaded with aqueous vapour. On this southern shore, near Guaruto, are situated the finest plantations of tobacco in the whole province.
Among the rivers flowing into the lake of Valencia some owe their origin to thermal springs, and deserve particular attention. These springs gush out at three points of the granitic Cordillera of the coast; near Onoto, between Turmero and Maracay; near Mariara, north-east of the Hacienda de Cura; and near Las Trincheras, on the road from Nueva Valencia to Porto Cabello. I could examine with care only the physical and geological relations of the thermal waters of Mariara and Las Trincheras. In going up the small river

- Pancratium undulatum, Amaryllis nervosa. $\dagger$ Potamogeton tenuifolium, Chara compressa, Typha tenuifolia.

Cura towards its source, the mountains of Mariara are seen advancing into the plain in the form of a vast amphitheatre, composed of perpendicular rocks, crowned by peaks with rugged summits. The central point of the amphitheatre bears the strange name of the Devil's Nook (Rincon del Diablo). The range stretching to the east is called El Chaparro ; that to the west, Las Viruelas. These ruin-like rocks command the plain; they are composed of a coarsegramed granite, nearly porphyritic, the yellowish white feldspar crystals of which are more than an inch and a half long. Mica is rare in them, and is of a fine silvery lustre. Nothing can be more picturesque and solemn than the aspect of this group of mountains, half covered with vegetation. The Peak of Calavera, which unites the Rincon del Diablo to the Chaparro, is visible from afar. In it the granite is separated by perpendicular fissures into prismatic masses. It would seem as if the primitive rock were crowned with columns of basalt. In the rainy season, a considerable sheet of water rushes down like a cascade from these cliffs. The mountains connected on the east with the Rincon del Diablo, are much less lofty, and contain, like the promontory of La Cabrera, and the little detached hills in the plain, gneiss and mica-slate, including garnets.

In these lower mountains, two or three miles north-east of Mariara, we find the ravine of hot waters called Quebrada de Aguas Calientes. This ravine, running N.W. $75^{\circ}$, contains several small basins. Of these the two uppermost, which have no communication with each other, are only eight inches in diameter; the three lower, from two to three feet. Their depth varies from three to fifteen inches. The temperature of these different funnels (pozos) is from $56^{\circ}$ to $59^{\circ}$; and what is remarkable, the lower funnels are hotter than the upper, though the difference of the level is only seven or eight inches. The hot waters, collected together, form a little rivulet, called the Rio de Aguas Calientes, which, thirty feet lower, has a temperature of only $48^{\circ}$. In seasons of great drought, the time at which we visited the ravine, the whole body of the thermal waters forms a section of only twenty-six square inches. This is considerably augmented in the rainy season; the rivulet is then transformed into a torrent, and its heat diminishes;
for it appears that the hot springs themselves are subject only to imperceptible variations. All these springs are slightly impregnated with sulphuretted hydrogen gas. The fetid smell, peculiar to this gas, can be perceived only by approaching very near the springs. In one of these wells only, the temperature of which is $56 \cdot 2^{\circ}$, bubbles of air are evolved at nearly regular intervals of two or three minutes. I observed that these bubbles constantly rose from the same points, which are four in number; and that it was not possible to change the places from which the gas is emitted, by stirring the bottom of the basin with a stick. These places correspond no doubt to holes or fissures on the gieiss; and indeed when the bubbles rise from one of the apertures, the emission of gas follows instantly from the other three. I could not succeed in inflaming, the small quantities of gas that rise above the thermal waters, or those I collected in a glass phial held over the springs, an operation that excited in me a nausea, caused less by the smell of the gas, than by the excessive heat prevailing in this ravine. Is this sulphuretted hydrogen mixed with a great proportion of carbonic acid or atmospheric air? I am doubtful of the first of these mixtures, though so common in thermal waters; for example at Aix la Chapelle, Enghien, and Barèges. The gas collected in the tube of Fontana's eudiometer had been shaken for a long time with water. The small basins are covered with a light film of sulphur, deposited by the sulphuretted hydrogen in its slow combustion in contact with the atmospheric oxygen. A few plants near the springs were incrusted with sulphur. This deposit is scarcely visible when the water of Mariara is suffered to cool in an open vessel; no doubt because the quantity of disengaged gas is very small, and is not renewed. The water, when cold, gives no precipitate with a solution of nitrate of copper; it is destitute of flavour, and very drinkable. If it contain any saline substances, for example, the sulphates of soda or magnesia, their quantities must be very insignificant. Being almost destitute of chemical tests,* we contented ourselves

- A small case, containing acetate of lead, nitrate of silver, alcohol, prussiate of potash, \&cc., had been left by mistake at Cumana. I evaporated some of the water of Mariara, and it yielded only a very small residuum, which, digested with nitric acid, appeared to contain only a little silica and extractive vegetable matter.
with filling at the spring two bottles, which were sent, along with the nourishing milk of the tree called palo de vaca, to MM. Fourcroy and Vauquelin, by the way of Porto Cabello and the Havannah. This purity in hot waters issuing immediately from granite mountains is in Europe, as well as in the New Continent, a most curious phenomenon.* How can we explain the origin of the sulphuretted hydrogen? It cannot proceed from the decomposition of sulphurets of iron, or pyritic strata. Is it owing to sulphurets of calcium, of magnesium, or other earthy metalloids, contained in the interior of our planet, under its rocky and oxidated crust?

In the ravine of the hot waters of Mariara, amidst little funnels, the temperature of which rises from $56^{\circ}$ to $59^{\circ}$, two species of aquatic plants vegetate; the one is membranaceous, and contains bubbles of air; the other has parallel fibres. The first much resembles the Ulva labyrinthiformis of Vandelli, which the thermal waters of Europe furnish. At the island of Amsterdam, tufts of lycopodium and marchantia have been seen in places where the heat of the soil was far greater: such is the effect of an habitual stimulus on the organs of plants. The waters of Mariara contain no aquatic insects. Frogs are found in them, which, being probably chased by serpents, have leaped into the funnels, and there perished.

South of the ravine, in the plain extending towards the shore of the lake, another sulphureous spring gushes out, less hot and less impregnated with gas. The crevice whence this water issues is six toises higher than the funnel just described. The thermometer did not rise in the crevice above $42^{\circ}$. The water is collected in a basin surrounded by large trees ; it is nearly circular, from fifteen to eighteen feet diameter, and three feet deep. The slaves throw themselves into this bath at the end of the day, when covered with dust, after having worked in the neighbouring fields of indigo and sugar-cane. Though the water of this bath (baño) is habitually from $12^{\circ}$ to $14^{\circ}$ hotter than the air, the negroes call it refreshing; because in the torrid zone this term is

* Warm springs equally pure are found issuing from the granites of Portugal, and those of Cantal. In Italy, the Pisciarelli of the lake Agnano have a temperature equal to $93^{\circ}$. Are these pure waters produced by condensed vapours?
used for whatever restores strength, calms the irritation of the nerves, or causes a feeling of comfort. We ourselves experienced the salutary effects of the bath. Having slung our hammocks on the trees round the basin, we passed a whole day in this charming spot, which abounds in plants. We found near the baño of Mariara the volador, or gyrocarpus. The winged fruits of this large tree turn like a fly-wheel, when they fall from the stalk. On shaking the branches of the volador, we saw the air filled with its fruits, the simultaneous fall of which presents the most singular spectacle. The two membranaceous and striated wings are turned so as to meet the air, in falling, at an angle of $45^{\circ}$. Fortunately the fruits we gathered were at their maturity. We sent some to Europe, and they have germinated in the gardens of Berlin, Paris, and Malmaison. The numerous plants of the volador, now seen in hot-houses, owe their origin to the only tree of the kind found near Mariara. The geographical distribution of the different species of gyrocarpus, which Mr. Brown considers as one of the laurineæ, is very singular. Jacquin saw one species near Carthagena in America.* This is the same which we met with again in Mexico, near Zumpango, on the road from Acapulco to the capital. $\dagger$ Another species, which grows on the mountains of Coromandel, $\ddagger$ has been described by Roxburgh; the third and fourth§ grow in the southern hemisphere, on the coasts of Australia.

After getting out of the bath, while, half-wrapped in a sheet, we were drying ourselves in the sun, according to the custom of the country, a little man of the mulatto race approached us. After bowing gravely, he made us a long speech on the virtues of the waters of Mariara, adverting to the numbers of invalids by whom they have been visited for some years past, and to the favourable situation of the springs, between the two towns Valencia and Caracas. He

- The Gyrocarpus Jacquini of Gärtner, or Gyrocarpus americanus of Willdenow.
$\dagger$ The natives of Mexico called it quitlacoctli. I saw some of its young leaves with three and five lobes; the full-grown leaves are in the form of a heart, and always with three lobes. We never met with the volador in flower.
$\ddagger$ This is the Gyrocarpus asiaticus of Willdenow. § Gyrocarpus sphenopterus, and G. rugosus.
showed us his house, a little hut covered with palm-leaves, situated in an enclosure at a small distance, on the bank of a rivulet, communicating with the bath. He assured us that we should there find all the conveniences of life; nails to suspend our hammocks, ox-leather to stretch over benches made of reeds, earthern vases always filled with cool water, and what, after the bath, would be most salutary of all, those great lizards (iguanas), the flesh of which is known to be a refreshing aliment. We judged from his harangue, that this good man took us for invalids, who had come to stay near the spring. His counsels and offers of hospitality were not altogether disinterested. He styled himself 'the inspector of the waters, and the pulpero* of the place.' Accordingly all his obliging attentions to us ceased as soon as he heard that we had come merely to satisfy our curiosity; or as they express it in the Spanish colonies, those lands of idleness, para ver, no mas, 'to see, and nothing more.' The waters of Mariara are used with success in rheumatic swellings, and affections of the skin. As the waters are but very feebly impregnated with sulphuretted hydrogen, it is necessary to bathe at the spot where the springs issue. Farther on, these same waters are employed for the irrigation of fields of indigo. A wealthy landed proprietor of Mariara, Don Domingo Tovar, had formed the project of erecting a bathing-house, and an establishment which would furnish visitors with better resources than lizard's flesh for food, and leather stretched on a bench for their repose.

On the 21st of February, in the evening, we set out from the beautiful Hacienda de Cura for Guacara and Nueva Valencia. We preferred travelling by night, on account of the excessive heat of the day. We passed by the hamlet of Punta Zamuro, at the foot of the high mountains of Las Viruelas. The road is bordered with large zamang-trees, or mimosas, the trunks of which rise to sixty feet high. Their branches, nearly horizontal, meet at more than one hundred and fifty feet distance. I have nowhere seen a vault of verdure more beautiful and luxuriant. The night was gloomy: the Rincon del Diablo with its denticulated rocks appeared from time to time at a distance, illumined

- Proprietor of a pulperia, or little shop where refreshments are sold.
by the burning of the savannahs, or wrapped in ruddy smoke. At the spot where the bushes were thickest, our horses were frightened by the yell of an animal that seemed to follow us closely. It was a large jaguar, which had roamed for three years among these mountains. He had constantly escaped the pursuits of the boldest hunters, and had carried off horses and mules from the midst of enclosures; but, having no want of food, had not yet attacked men. The negro who conducted us uttered wild cries, expecting by these means to frighten the tiger; but his efforts were ineffectual. The jaguar, like the wolf of Europe, follows travellers even when he will not attack them; the wolf in the open fields and in unsheltered places, the jaguar skirting the road and appearing only at intervals between the bushes.

We passed the day on the 23 r d in the house of the Marquis de Toro, at the village of Guacara, a very considerable Indian community. An avenue of carolineas leads from Guacara to Mocundo. It was the first time I had seen in the open air this majestic plant, which forms one of the principal ornaments of the extensive conservatories of Schönbrunn.* Mocundo is a rich plantation of sugarcanes, belonging to the family of Toro. We there find, what is so rare in that country, a garden, artificial clumps of trees, and on the border of the water, upon a rock of gneiss, a pavilion with a mirador, or belvidere. The view is delightful over the western part of the lake, the surrounding mountains, and a forest of palm-trees that separates Guacara from the city of Nueva Valencia. The fields of sugar-cane, from the soft verdure of the young reeds, resemble a vast meadow. Everything denotes abundance; but it is at the price of the liberty of the cultivators. At Mocundo, with two hundred and thirty negroes, seventyseven tablones, or cane-fields, are cultivated, each of which, ten thousand varas square, $\dagger$ yields a net profit of two

[^187]hundred or two hundred and forty piastres a-year. The creole cane and the cane of Otaheite* are planted in the month of April, the first at four, the second at five feet distance. The cane ripens in fourteen months. It flowers in the month of October, if the plant be sufficiently vigorous; but the top is cut off before the panicle unfolds. In all the monocotyledonous plants (for example, the maguey cultivated at Mexico for extracting pulque, the wineyielding palm-tree, and the sugar-cane), the flowering alters the quality of the juices. The preparation of sugar, the boiling, and the claying, are very imperfect in Terra Firma, because it is made only for home consumption; and for wholesale, papelon is preferred to sugar, either refined or raw. This papelon is an impure sugar, in the form of little loaves, of a yellow-brown colour. It contains a mixture of molasses and mucilaginous matjer. The poorest man eats papelon, as in Europe he eats cheese. It is believed to have nutritive qualities. Fermented with water it yields the guarapo, the favourite beverage of the people. In the province of Caracas subcarbonaie of potash is used, instead of lime, to purify the juice of the sugar-cane. The ashes of the bucare, which is the Erythrina corallodendrum, are preferred.

The sugar-cane was introduced very late, probably towards the end of the sixteenth century, from the West India Islands, into the valleys of Aragua. It was known in India, in China, and in all the islands of the Pacific, from the most remote antiquity; and it was planted at Khorassan, in Persia, as early as the fifth century of our era, in order to obtain from it solid sugar. $\dagger$ The Arabs carried this reed, so useful to the inhabitants of hot and temperate countries, to the shores of the Mediterranean. In 1306, its cultivation was yet unknown in Sicily; but was already common in the island of Cyprus, at Rhodes, and in the Morea. A hundred years after it enriched Calabria, Sicily, and the coasts of Spain. From Sicily the Infante Don Henry trans-

[^188]planted the cane to Madeira: from Madeira it passed to the Canary Islands, where it was entirely unknown; for the 'ferulæ' of Juba, 'quæ expressæ liquorem fundunt potui jucundum,' are euphorbias (the Tabayba dulce), and not, as has been recently asserted,* sugar-canes. Twelve sugarmanufactories (ingenios de azucar) were soon established in the island of Great Canary, in that of Palma, and between Adexe, Icod, and Guarachico, in the island of Teneriffe. Negroes were employed in this cultivation, and their descendants still inhabit the grottos of Tiraxana, in the Great Canary. Since the sugar-cane has been transplanted to the West Indies, and the New World has given maize to the Canaries, the cultivation of the latter has taken the place of the cane at Teneriffe and the Great Canary. The cane is now found only in the island of Palma, near Argual and Tazacorte, $\dagger$ where it yields scarcely one thousand quintals of sugar a year. The sugar-cane of the Canaries, which Aiguilon transported to St. Domingo, was there cultivated extensively as early as 1513 , or during the six or seven following years, under the auspices of the monks of St. Jerome. Negroes were employed in this cultivation from its commencement ; and in 1519 representations were made to government, as in our own time, that the West India Islands would be ruined and made desert, if slaves were not conveyed thither annually from the coast of Guinea.

For some years past the culture and preparation of sugar has been much improved in Terra Firma; and, as the process of refining is prohibited by the laws at Jamaica, they reckon on the fraudulent exportation of refined sugar to the English colonies. But the consumption of the provinces of Venezuela, in papelon, and in raw sugar employed in making chocolate and sweetmeats (dulces) is so enormous, that the exportation has been hitherto entirely null. The finest plantations of sugar are in the valleys of Aragua and of the Tuy, near Pao de Zarate, between La Victoria

- On the origin of cane-sugar, in the Journal de Pharmacie, 1816, p. 387. The Tabayba dulce is, according to Von Buch, the Euphorbia balsamifera, the juice of which is neither corrosive nor bitter like that of the cardon, or Euphorbia canariensis.
+ "Notice sur la Culture du Sucre dans les Isles Canariennes," by Leopold von Buch.
and San Sebastian, near Guatire, Guarenas, and Caurimare. The first canes arrived in the Now World from the Canary Islands; and even now Canarians, or Isleños, are placed at the head of most of the great plantations, and superintend the labours of cultivation and refining.
It is this connexion between the Canarians and the inhabitants of Venezuela, that has given rise to the introduction of camels into those provinces. The Marquis del Toro caused three to be brought from Lancerote. The expense of conveyance was very considerable, owing to the space which these animals occupy on board merchant-vessels, and the great quantity of water they require during a long sea-voyage. A camel, bought for thirty piastres, costs between eight and nine hundred before it reaches the coast of Caracas. We saw four of these animals at Mocundo; three of which had been bred in America. Two others had died of the bite of the coral, a venomous serpent very common on the banks of the lake. These camels have hitherto been employed only in the conveyance of the sugarcanes to the mill. The males, stronger than the females, carry from forty to fifty arrobas. A wealthy landholder in the province of Varinas, encouraged by the example of the Marquis del Toro, has allotted a sum of 15,000 piastres for the purpose of bringing fourteen or fifteen camels at once from the Canary Islands. It is presumed these beasts of burden may be employed in the conveyance of merchandise across the burning plains of Casanare, from the Apure and Calabozo, which in the season of drought resemble the deserts of Africa. How advantageous it would have been had the Conquistadores, from the beginning of the sixteenth century, peopled America with camels, as they have peopled it with horned cattle, horses, and mules. Wherever there are immense distances to cross in uninhabited lands; whereever the construction of canals becomes difficult (as in the isthmus of Panama, on the table-land of Mexico, and in the deserts that separate the kingdom of Quito from Peru, and Peru from Chile), camels would be of the highest importance, to facilitate inland commerce. It seems the more surprising, that their introduction was not encouraged by the government at the beginning of the conquest, as, long after the taking of Grenada, camels, for which the Moors
had a great predilection, were still very common in the south of Spain. A Biscayan, Juan de Reinaga, carried some of these animals at his own expense to Peru. Father Acosta saw them at the foot of the Andes, about the end of the sixteenth century; but little care being taken of them, they scarcely ever bred, and the race soon became extinct. In those times of oppression and cruelty, which have been described as the era of Spanish glory, the commendataries (encomenderos) let out the Indians to travellers like beasts of burden. They were assembled by hundreds, either to carry merchandise across the Cordilleras, or to follow the armies in their expeditions of discovery and pillage. The Indians endured this service more patiently, because, owing to the almost total want of domestic animals, they had long been constrained to perform it, though in a less inhuman manner, under the government of their own chiefs. The introduction of camels attempted by Juan de Reinaga spread an alarm among the encomenderos, who were, not by law, but in fact, lords of the Indian villages. The court listened to the complaints of the encomenderos; and in consequence America was deprived of one of the means which would have most facilitated inland communication, and the exchange of productions. Now, however, there is no reason why the introduction of camels should not be attempted as a general measure. Some hundreds of these useful animals, spread over the vast surface of America, in hot and barren places, would in a few years have a powerful influence on the public prosperity. Provinces separated by steppes would then appear to be brought nearer to each other; several kinds of inland merchandize would diminish in price on the coast; and by increasing the number of camels, above all the species called hedjin, or 'the ship of the desert,' a new life would be given to the industry and commerce of the New World.

On the evening of the 22nd we continued our journey from Mocundo by Los Guayos to the city of Nueva Valencia. We passed a little forest of palm-trees, which resembled, by their appearance, and their leaves spread like a fan, the Chamærops humilis of the coast of Barbary. The trunk, however, rises to twenty-four and sometimes thirty feet
high. It is probably a new species of the genus corypha; and is called in the country paima de sombrero, the footstalks of the leaves being employed in weaving hats resembling our straw hats. This grove of palm-trees, the withered foliage of which rustles at the least breath of air-the camels feeding in the plain-the undulating motion of the vapours on a soil scorched by the ardour of the sun, give the landscape an African aspect. The aridity of the land augments as the traveller approaches the town, after passing the western extremity of the lake. It is a clayey soil, which has been levelled and abandoned by the waters. The neighbouring hills, called Los Morros de Valencia, are composed of white tufa, a very recent limestone formation, immediately covering the gneiss. It is again found at Victoria, and on several other points along the chain of the coast. The whiteness of this tufa, which reflects the rays of the sun, contributes greatly to the excessive heat felt in this place. Everything seems smitten with sterility; scarcely are a few plants of cacao found on the banks of the Rio de Valencia; the rest of the plain is bare, and destitute of vegetation. This appearance of sterility is here attributed, as it is everywhere in the valleys of Aragua, to the cultivation of indigo; which, according to the planters, is, of all plants, that which most exhausts (cansa) the ground. The real physical causes of this phenomenon would be an interesting inquiry, since, like the effects of fallowing land, and of a rotation of crops, it is far from being sufficiently understood. I shall only observe in general, that the complaints of the increasing sterility of cultivated land become more frequent between the tropics, in proportion as they are near the period of their first breaking-up. In a region almost destitute of herbs, where every plant has a ligneous stem, and tends to raise itself as a shrub, the virgin soil remains shaded either by great trees, or by bushes; and under this tufted shade it preserves everywhere coolness and humidity. However active the vegetation of the tropics may appear, the number of roots that penetrate into the earth, is not so great in an uncultivated soil; while the plants are nearer to each other in lands subjected to cultivation, and covered with indigo, sugar-canes, or cassava. The trees and shrubs, loaded with
branches and leaves, draw a great part of their nourishment from the ambient air; and the virgin soil augments its fertility by the decomposition of the vegetable substances which progressively accumulate. It is not so in the fields covered with indigo, or other herbaceous plants; where the rays of the sun penetrate freely into the earth, and by the accelerated combustion of the hydrurets of carbon and other acidifiable principles, destroy the germs of fecundity. These effects strike the imagination of the planters the more forcibly, as in lands newly inhabited they compare the fertility of a soil which has been abandoned to itself during thousands of years, with the produce of ploughed fields. The Spanish colonies on the continent, and the great islands of Porto-Rico and Cuba, possess remarkable advantages with respect to the produce of agriculture over the lesser West India Islands. The former, from their extent, the variety of their scenery, and their small relative population, still bear all the characters of a new soil; while at Barbadoes, Tobago, St. Lucia, the Virgin Islands, and the French part of St . Domingo, it may be perceived that long cultivation has begun to exhaust the soil. If in the valleys of Aragua, instead of abandoning the indigo grounds, and leaving them fallow, they were covered during several years, not with corn, but with other alimentary plants and forage; if among these plants such as belong to different families were preferred, and which shade the soil by their large leaves, the amelioration of the fields would be gradually accomplished, and they would be restored to a part of their former fertility.

The city of Nueva Valencia occupies a considerable extent of ground, but its population scarcely amounts to six or seven thousand souls. The streets are very broad, the market place, (plaza mayor,) is of vast dimensions; and, the houses being low, the disproportion between the population of the town, and the space that it occupies, is still greater than at Caracas. Many of the whites, (especially the poorest,) forsake their houses, and live the greater part of the year in their little plantations of indigo and cotton, where they can venture to work with their own hands; which, according to the inveterate prejudices of that country, would be a disgrace to them in the town.

[^189]D

Nueva Valencia, founded in 1555 under the government of Villacinda, by Alonzo Diaz Moreno, is twelve years older than Caracas. Valencia was at first only a dependency of Burburata; but this latter town is nothing now but a place of embarkation for mules. It is regretted, and perhaps justly, that Valencia has not become the capital of the country. Its situation in a plain, on the banks of a lake, recalls to mind the position of Mexico. When we reflect on the easy communication afforded by the valleys of Aragas with the Llanos and the rivers that flow into the Orinoco; when we recognize the possibility of opening an inland navigation, by the Rio Pao and the Portugaesa, as far as the mouths of the Orinoco, the Cassiquiare, and the Amazon, it may be conceived that the capital of the vast provinces of Venezuela would have been better placed near the fine harbour of Porto Cabello, beneath a pure and serene sky, than near the unsheltered road of La Guayra, in a temperate but constantly foggy valley. Near the kingdom of New Grenada, and situate between the fertile corn-lands of La Victoria and Barquesimeto, the city of Valencia ought to have prospered; but, notwithstanding these advantages, it has been unable to maintain the contest with Caracas.

Only those who have seen the myriads of ants, that infest the countries within the torrid zone, can form an idea of the destruction and the sinking of the ground occasioned by these insects. They abound to such a degree on the site of Valencia, that their excavations resemble subterranean canals, which are filled with water in the time of the rains, and become very dangerous to the buildings. Here recourse has not been had to the extraordinary means employed at the beginning of the sixteenth century in the island of St. Domingo, when troops of ants ravaged the fine plains of La Vega, and the rich possessions of the order of St. Francis. The monks, after having in vain burnt the larvæ of the ants, and had recouse to fumigations, advised the inhabitants to choose by lot a saint, who would act as a mediator against the plague of the ants.* The honour of the choice fell on St. Saturnin; and the ants disappeared as soon as the first festival of this saint was celebrated. Incredulity has made great progress since the time of the conquest; and it was

[^190]onk on the back of the Cordilleras that I found a small chapel, deatined, according to its insacription, for prayers to be addressed to Heaven for the destruction af the termites.

Valencia affords some historical remembrances; but these, like everything connected with the colonies, have no remote date, and recall to mind either civil discords or sanguinary conflicts with the savages. Lopez de Aguirre, whose crimes and adventures form some of the most dramatic episodes of the history of the conquest, proceeded in 1561, from Peru, by the river Amazon to the island of Margareta; and thence, by the port of Burburata, into the valleys of Aragaa. On his entrance into Valencia, which proudly entitles itself 'the City of the King,' he proclaimed the independance of the country, and the deposition of Philip II. The inhabitants withdrew to the islands of the lake of Tacarigua, taking with them all the boats from the shore, to be more secure in their retreat. In consequence of this stratagem, Aguirre could exercise his cruelties only on his own people. From Valencia he addressed to the king of Spain, a remarkable letter, in which he boasts alternately of his crimes and his piety; at the same time giving advice to the king on the government of the colonies, and the system of missions. Surrounded by savage Indians, navigating on a great sea of freah water, as he calls the Amazon, he is alarmed at the heresies of Martin Luther, and the increasing influence of echismatios in Europe." Loper de Aguirre, or as he is still

- The following are some remarkable passages in the letter from Aguirre to the king of Spain.
"King Philip, native of Spain, son of Charles the Invincible!. I, Lopez de Aguirre, thy vassal, an old Christian, of poor but noble parenta, and a native of the town of Onate in Biscay, passed over young to Peru, to labour lance in hand. I rendered thee great services in the conquest of India. I fought for thy glory, without demanding pay of thy officers, as is proved by the books of thy treasury. I firmly believe, Christian King and Lord, that, very ungrateful to me and my companions, all those who write to thee from this land [America], deceive thee much, because thou seest things from too far off. I recommend to thee to be more just toward the good rassals whom thou hast in this country: for I and mine, weary of the cruelties and injustice which thy viceroys, thy governors, and thy judges, exercise in thy name, are resolved to obey thee no more. We regard ourselves no longer as Spaniards. We wage a cruel war against thoe, because we will not endure the oppression of thy ministers; who, to give places to their nephews and their childran, dispose of our liven,
called by the common people, 'the Tyrant,' was killed at Barquesimeto, after having been abandoned by his own men. At the moment when he fell, he plunged a dagger into the bosom of his only daughter, "that she might not have to
our reputation, and our fortune. I am lame in the left foot from two shots of an arquebuss, which I received in the valley of Coquimbo, fighting under the orders of thy marshal, Alonzo de Alvarado, against Francis Hernandez Giron, then a rebel, as I am at present, and shall be always; for since thy viceroy, the Marquis de Cañete, a cowardly, ambitious, and effeminate man, has hanged our most valiant warriors, I care no more for thy pardon than for the books of Martin Luther. It is not well in thee, King of Spain, to be ungrateful toward thy vassals; for it was whilst thy father, the emperor Charles, remained quietly in Castile, that they procured for thee so many kingdoms and vast countries. Remember, King Philip, that thou hast no right to draw revenues from .these provinces, the conquest of which has been without danger to thee, .but inasmuch as thou recompensest those who have rendered thee such great services. I am certain that few kings go to heaven. Therefore we regard ourselves as very happy to be here in the Indies, preserving in all their purity the commandments of God, and of the Roman Church; and we intend, though sinners daring life, to become one day martyrs to the glory of God. On going out of the river Amazon, we landed in an island called La Margareta. We there received news from Spain of the great faction and machination (maquina) of the Lutherams. This news :alarmed us extremely; we found among us one of that faction; his name was Monteverde. I had him cut to pieces, as was just: for, believe me, Sefior, wherever I am, people live according to the law. But the corruption of morals among the monks is 80 great in this land that it is necessary to chastise it severely. There is not an ecclesiastic here who does not think himself higher than the governor of a province. I beg of thee, great King, not to believe what the monks tell thee down yonder in Spain. They are always talking of the sacrifices they make, as well as of the hard and bitter life they are forced to lead in America: while they occupy the richest lands, and the Indians hant and fish for them every day. If they shed tears before thy throne, it is that thou mayest send them hither to govern provinces. Dost thou know what sort of life they lead here? Given up to luxury, acquiring possessions, selling the sacraments, being at once ambitious, violent, and gluttonous; such is the life they lead in America. The faith of the Indians suffer by such bad examples. If thou dost not change all this, $O$ King of Spain, thy government will not be stable.
" What a misfortune that the Emperor, thy father, should have conquered Germany at such a price, and spent, on that conquest, the money we procured for him in these very Indies! In the year 1559 the Marquis de Cafiete sent to the Amazon, Pedro de Ursua, a Navarrese, or rather a Frenchman : we sailed on the largest rivers of Peru till we came to a gulf of fresh water. We had already gone three handred leagues
blush before the Spaniards at the name of the daughter of a traitor." The soul of the tyrant (such is the belief of the natives) wanders in the savannahs, like a flame that flies the approach of men.*
The second historical event connected with the name of Valencia is the great incursion made by the Caribs of the Orinoco in 1578 and 1580. That cannibal horde went up the banks of the Guarico, crossing the plains or llanos. They were happily repulsed by the valour of Garcia Gonzales, one of the captains whose names are still most revered in those provinces. It is gratifying to recollect, that the descendants of those very Caribs now live in the missions ${ }^{\text {as }}$ peaceable husbandmen, and that no savage nation of Guiana dares to cross the plains which separate the region of the forests from that of cultivated land. The Cordillera of the coast is intersected by several ravines, very uniformly directed from south-east to north-west. This phenomenon is general from the Quebrada of Tocume, between Petares and Caracas, as far as Porto Cabello. It would seem as if the impulsion had everywhere come from the south-east; and this fact is the more striking, as the strata of gneiss and

[^191]inica-slate in the Cordillera of the const are generally divi: directed from the south-west to the north-east. Most of these ravines penetrate into the mountains at their southerm declivity, without crossing them entirely. But there is an: opening (abra) on the meridian of Nueva Valencia, which leads towards the coast, and by which a cooling sea-breeze penetrates every evening into the valleys of Aragua. Thist breeze rises regularly two or three hours after sumset.

By this abra, the farm of Barbula, and an eastern branch of the ravine, a new road is being constructed from Va lencia to Porto Cabello. It will be so short, that it will require only four hours to reach the port; and the travellere will be able to go and return in the same day from the coast to the valleys of Aragua. In order to examine this roed, we set out on the 26th of February in the evening for the farmi of Barbula.

On the morning of the 276 h we visited the hot springs of Eat Trinchera, three leagues from Valencia. The ravine is very large, and the descent admost continual from the banks of the lake to the sea-coast. La Trinchera takes its namae from some fortifications of earth, thrown up in 1677 by the French buccaneers, who sacked the town of Valencia. The hot springs (and this is a remarkable geological fact,) do not issue on the south side of the mountains, like those of Mariara, Onoto, and the Brigantine; but they issue from the chain itself, almost at its northern declivity. They are much more abundant than any we had till then seen, forming a rivulet which, in times of the greatest drought, is two feet dieep and eighteen wide. The temperature of the water, measured with great care, was $90 \cdot 3^{\circ}$ of the centigrade thermometer. Nert to the springs of Urijino, in Japan, which are asserted to be pure water at $100^{\circ}$ of temperature, the waters of the Trinchera of Porto Cabello appear to be the hottest in the world. We breakfasted near the spring; egge plunged into the water were boiled in less than four minutes. These waters, strongly charged with sulphuretted hydrogen, gush out from the back of a hill rising one hundred and fifty feet above the bottom of the ravine, and tending. from south-south-east to north-north-west. The roek. from which the springs gueh, is a real coarse-grained granite, resembling that of the Rincon del Diablo, in the mountains
of Mariara. Wherever the waters evaporate in the air, they: form sediments and incrustations of carbonate of lime; posaibly they traverse strata of primitive limestone, so common in the mica-slate and gneiss of the cossts of Caracas. We were sarprised at the luxuriant vegetation that surrounds the basin; mimosas with slender pinnate leaves, clusias, and fig-trees, have pushed their roots into the bottom of a pool, the temperature of which is $85^{\circ}$; and the branches of these trees extended over the surface of the water, at two or three inches distance. The foliage of the mimosas, though constantly enveloped in the hot vapours, displayed the most beartiful verdure. An arum, with a woody stem, and with large sagittate leaves, rose in. the very middle of a pool the .temperature of which was $70^{\circ}$. Plants of the same species regetate in other parts of those mountains at the brink of torrents, the temperature of which is not $18^{\circ}$. What is still more singuilar, forty feet distant from the point whence the springs gash out at a temperature of $90^{\circ}$, other springs are found perfectly cold. They all follow for some time a parallel direction; and the natives showed us that, by digging a hole between the two rivulets, they could procure a bath of any given temperature they pleased. It seems remarkable, that in the hottest as well as the coldest climates, people display the same predilection for heat. On the introduction of Christianity into Iceland, the inhabitants would be baptized only in the hot springs of Hecla: and in the torrid zone, in the plains, as well as on the Cordilleras, the natives flock from all parts to the thermal waters. The sick, who come to La Trinchera to use vapour-baths, form a sort of framework over the spring with branches of trees and very slendor reeds. They stretch themselves naked on this frame, which appeared to me to possess little strength, and to be dangerous of access. The Rio de Aguas Calientes runs towards the north-east, and becomes, near the coast, a considerable river, swarming with great crocodiles, and contributing, by its inundations, to the insalubrity of the shore.
We descended towards Porto Cabello, having eonstantly the river of hot water on our right. The road is extremely pietaresque, and the waters roll down on the shelves of rock. We might have fancied we were gazing on the cascadee of the Reuss, that flows doven Mount St. Gothard;
but what a contrast in the vigour and richness of the vegetation! The white trunks of the cecropia rise majestically amid bignonias and melastomas. They do not disappear till we are within a hundred toises above the level of the ocean. A small thorny palm-tree extends also to this limit; the slender pinnate leaves of which look as if they had been curled toward the edges. This tree is very common in these mountains; but not having seen either its fruit or its flowers, we are ignorant whether it be the piritu palm-tree of the Caribbees, or the Cocos aculeata of Jacquin.

The rock on this road presents a geological phenomenon, the more remarkable as the existence of real stratified granite has long been disputed. Between La Trinchera and the Hato de Cambury a coarse-grained granite appears, which, from the disposition of the spangles of mica, collected in small groups, scarcely admits of confounding with gneiss, or with rocks of a schistose texture. This granite, divided into ledges of two or three feet thick, is directed $52^{\circ}$ northeast, and slopes to the north-west regularly at an angle of from $30^{\circ}$ or $40^{\circ}$. The feldspar, crystallized in prisms with four unequal sides, about an inch long, passes through every variety of tint from a flesh-red to yellowish white. The mica, united in hexagonal plates, is black, and sometimes green. The quartz predominates in the mass; and is generally of a milky white. I observed neither hornblende, black schorl, nor rutile titanite, in this granite. In some ledges we recognised round masses, of a blackish gray, very quartzose, and almost destitute of mica. They are from one to two inches diameter; and are found in every zone, in all granite mountains. These are not imbedded fragments, as at Greiffenstein in Saxony, but aggregations of particles which seem to have been subjected to partial attractions. I could not follow the line of junction of the gneiss and granitic formations. According to angles taken in the valleys of Aragua, the gneiss appears to descend below the granite, which must consequently be of a more recent formation. The appearance of a stratified granite excited my attention the more, because, having had the direction of the mines of Fichtelberg in Franconia for several years, I was accustomed to see granites divided into ledges of three or four feet thick, but little inclined, and
forming masses like towers, or old ruins, at the summit of the highest mountains.*
The heat became stifling as we approached the coast. A reddish vapour veiled the horizon. It was near sunset, and the breeze was not yet stirring. We rested in the lonely farms known under the names of the Hato de Cambury and 'the House of the Canarian' (Casa del Isleño). The river of hot water, along the banks of which we passed, became deeper. A crocodile, more than nine feet long, lay dead on the strand. We wished to examine its teeth, and the inside of its mouth; but having been exposed to the sun for several weeks, it exhaled a smell so fetid that we were obliged to relinquish our design and remount our horses. When we arrived at the level of the sea, the road turned eastward, and crossed a barren shore a league and a half broad, resembling that of Cumana. W.e there found some scattered cactuses, a sesuvium, a few plants of Coccolobs uvifera, and along the coast some avicennias and mangroves. We forded the Guayguaza and the Rio Estevan, which, by their frequent overflowing, form great pools of stagnant water. Small rocks of meandrites, madrepores, and other corals, either ramified or with a rounded surface, rise in this vast plain; and seem to attest the recent retreat of the sea. But these masses, which are the habitations of polypi, are only fragments imbedded in a breccia with a calcareous cement. I say a breccia, because we must not confound the fresh and white corallites of this very recent littoral formation, with the corallites blended in the mass of transition-rocks, grauwacke, and black limestone. We were astonished to find in this uninhabited spot a large Parkinsonia aculeata loaded with flowers. Our botanical works indicate this tree as peculiar to the New World; but during five years we saw it only twice in a wild state, once in the plains of the Rio Guayguaza, and once in the llanos of Cumana, thirty leagues

[^192]from the const, near la Villa del Pao, but there was reason to believe that this latter place had onee been a connco, or cultivated enclosure. Pverywhere else on the continent of America we saw the Parkinsonia, like the Phumeria, only in the gardens of the Indians.

At Porto Cabello, as at La Guayra, it is disputed whether the port lies east or west of the town, with which the communications are the most frequent. The inhabitants believe that Porto Cabello is north-north-wesit of Naeva Valencia; and my observations give a longitude of three or four minutes more towards the west.

We were reeeived with the utmost kindmess in the house of a French physician, M. Juhiac, who had studied medicine at Montpelier. His small house contained a collection of things the most various, but which were all calculated to interest travellers. "We found works of literature and ratural history; notes on meteorology; skins of the jaguar and of large aquatic serpents ; live animals, monkeys, armadilloes, and birds. Our host was principal surgeon to the royal hospital of Porto Cabello, and was celebrated in the country for his skilful treatment of the yellow fever. During a period of seven years he had seen six or eight thousand persons enter the hospitals, attacked by this cruel malady. He had observed the ravages that the epidemic caused in Admiral Ariztizabal's fleet, in 1793. That fleet lost nearly a third of its men; for the sailors were almost all unseasoned Europeans, and held unrestrained intercourse with the shore. M. Juliac had heretofore treated the sick as was commonly practised in Terra Firma, and in the island, by bleeding, aperient medicines, and acid drinks. In this treatment no attempt was made to raise the vital powers by the action of stimulants, so that, in attempting to allay the fever, the languor and debility were augmented. In the hospitals, where the sick were crowded, the mortality was often thirty-three per cent. among the white Creoles; and sixty-five in a hundred among the Europeans recently disembarked. Since a stimulant treatment, the use of opium, of benzoin, and of alcoholic draughts, has been substituted. for the old debilitating method, the mortality has comsiderably diminished. It was believed to be reduced to twenty. in handred among Europeans, and ten among

Oreoles;* even when black vomiting, and homorrhage fromthe nose, ears, and gums, indicated a high degree of exacerbation in the malady. I relate faithfully what was then given as the general result of observation: but I think, in these numerical comparisons, it must not be forgotten, that, notwithstanding appearances, the epidemics of several successive years do not resemble each other; and that, in order to decide on the use of fortifying or debilitating remedies, (if indeed this difference exist in an absolute sense, we must distinguish between the various periods of the malady.
The climate of Porto Cabello is less ardent than that of La Guayra. The breeze there is stronger, more frequent, and more regular. The houses do not lean against rocks that absorb the rays of the sun during the day, and emit: caloric at night, and the air can circulate more freely between: the coast and the mountains of Ilaria. The causes of the insalubrity of the atmospere must be sought in the shores: that extend to the east, as far as the eye can reach, towards the Punta de Tucasos, near the fine port of Chichiribiche. There are situated the salt-works; and there, at the beginning of the rainy season, tertian fevers prevail, and eaaily degenerate into asthenic fevers. It is affirmed that the mestizoes who are employed in the salt-works are more tawny, and have a yellower skin, when they have suffered several successive years from those fevers, which are called 'the malady of the coast.' The poor fishermen, who dwell. on this shore, are of opinion that it is not the inundations: of the sea, and the retreat of the salt-water, which render. the lands covered with mangroves so unhealthful; $\dagger$ they

[^193]believe that the insalubrity of the air is owing to the fresh water, that is, to the overflowings of the Guayguaza and Estevan, the swell of which is so great and sudden in the months of October and November. The banks of the Rio Estevan have been less insalubrious since little plantations of maize and plantains have been established; and, by raising and hardening the ground, the river has been confined within narrower limits. A plan is formed of giving another issue to the Rio San Estevan, and thus to render the environs of Porto Cabello more wholesome. A canal is to lead the waters toward that part of the coast which is opposite the island of Guayguaza.

The salt-works of Porto Cabello somewhat resemble those of the peninsula of Araya, near Cumana. The earth, however, which they lixivate by collecting the rain-water into small basins, contains less salt. It is questioned here, as at Cumana, whether the ground be impregnated with saline particles because it has been for ages covered at intervals with sea-water evaporated by the heat of the sun, or whether the soil be muriatiferous, as in a mine very poor in native salt. I had not leisure to examine this plain with the same attention as the peninsula of Araya. Besides, does not this problem reduce itself to the simple question, whether the salt be owing to new or very ancient inundations? The labouring at the salt-works of Porto Cabello being extremely unhealthy, the poorest men alone engage in it. They collect the salt in little stores, and afterwards sell it to the shopkeepers in the town.

During our abode at Porto Cabello, the current on the coast, generally directed towards the west,* ran from west to east. This upward current (corriente por arriba), is very frequent during two or three months of the year, from September to November. It is believed to be owing to some north-west winds that have blown between Jamaica and Cape St. Antony in the island of Cuba.

[^194]The military defence of the coasts of Terra Firma rests on six points: the castle of San Antonio at Cumana; the Morro of Nueva Barcelona; the fortifications of La Guayra, (mounting one hundred and thirty-four guns); Porto Cabello; fort San Carlos, (at the mouth of the lake of Maracaybo) ; and Caz ihagena. Porto Cabello is, next to Carthagena, the most i,nportant fortified place. The town of Porto Cabello is quite modern, and the port is one of the finest in the world. Art has had scarcely anything to add to the adraatages which the nature of the spot presents. A neck of land stretches first towards the north, and then towards the west. Its western extremity is opposite to a range of islands connected by bridges, and so close together that they might be taken for another neck of land. These islands are all composed of a calcareous breccia of extremely recent formation, and analagous to that on the coast of Cumana, and near the castle of Araya. It is a conglomerate, containing fragments of madrepores and other corals cemented by a limestone basis and grains of sand. We had already seen this conglomerate near the Rio Guayguaza. By a singular disposition of the ground the port resembles a basin or a little inland lake, the southern extremity of which is filled with little islands covered with mangroves. The opening of the port towards the west contributes much to the smoothness of the water." One vessel only can enter at a time; but the largest ships of the line can anchor very near land to take in water. There is no other danger in entering the harbour than the reefs of Punta Brava, opposite which a battery of eight guns has been erected. Towards the west and south-west we see the fort, which is a regular pentagon with five bastions, the battery of the reef, and the fortifications that surround the ancient town, founded on an island of a trapezoidal form. A bridge and the fortified gate of the Staccado join the old to the new town; the latter is already larger than the

[^195]formear, though considered ouly its suburb. The bottom of the bamin or lake which forms the harbour of Porto Cabello, turns behind this suburb to the south-west. It is a marshy ground filled with noisome and stagnant water. The town, which has at present nearly nine thousand inhabitants, owes its origin to an illicit commerce, attracted to these shores by the proximity of the town of Burburata, which was founded in 1549. It is only since the administration of the Biscayans, and of the company of Guipuzcoa, that Porto Cabello, which was but a hamlet, has been converted into a well-fortified town. The vessels of La Guayra, which is less a port than a bad open roadstead, come to Porto Cabello to be caulked and repaired.

The real defence of the harbour consists in the low batteries on the neck of land at Punta Brava, and on the reef; but from ignorance of this principle, a new fort, the Mirador of Solano" has been constructed at a great expense, on the mountains commanding the suburb towards the south. More than ten thousand mules are annually exported from Porto Cabella. It is curious enough to see these animals embarked; they are thrown down with ropes, and then hoisted on board the vessels by means of a machine resembling a crane. Ranged in two files, the mules with difficulty keep their footing during the rolling and pitching of the ship; and in order to frighten and render them more docile, a drum is beaten during a great part of the day and night. We may guess what quiet a passenger enjoys, who has the courage to embark for Jamaica in a schooner laden with mules.

We laft Porto Cabello on the first of March, at sunrise. We saw with surprise the great number of boats that were laden with fruit to be sold at the market. It reminded me of a fine morning at Venice. The town presents in general, on the side towards the sea, a cheerful and agreeable aspect. Mountains covered with vegetation, and crowned with peaks called Las Tetas de Ilaria, which, from their outline would be taken for rocks of a trap-formation, form the background of the landscape. Near the coast all is bare, white, and strongly illumined, while the screen of mountains

[^196]is clothed with trees of thick foliage that project their vait shadows upon the brown and rocky grourd. On going out of the town we visited an aqueduct that had been juet finished. It is five thousand varas long, and conveys the waters of the Rio Estevan by a trench to the town. This work has cost more than thirty thousand piastnes; but its waters gush out in every street.

We returned fram Porta Cabello to the valleys of Anagua, and stopped at the Farm of Barbula, near which, a new road to Valencia is in the course of construction. We had heard, several weeks before, of a tree, the sap of which is a nourishing milk. It is called 'the cow-tree'; and we were ascured that the negroes of the farm, who drink plentifilly of this vegetable milk, consider it a wholesome aliment. All the milky juices of plants being acrid, bitter, and more or less poisonous, this account appeared to us very extreondinary; but we found by experience during our stay at Barbula, that the virtues of this tree had not been exaggerated. This fine tree rises like the broad-leaved starapple.* Its oblong and pointed leaves, rough and alternate, are marked by lateral ribs, prominent at the lower surface, and parallel. Some of them are ten inches long. We did not see the flower: the fruit is somewhat fleshy, and contains one and sometimes two nuts. When incisions are made in the trunk of this tree, it yields abundance of a glutinous milk, tolerably thick, devoid of all acridity, and of an agreeable and baimy smell. It was offered to us in the shell of a calabash. We drank considerable quantities of it in the evening before we went to bed, and very early in the morning, without feeling the least injurious effect. The viscosity of this milk alone renders it a little disagreoable. The negroes and the free people who work in the plantations drink it, dipping into it their bread of maize or cassava. The overseer of the farm told us that the negroes grow sensibly fatter during the season when the palo de vaca furnishes them with most milk. This juice, exposed to the air, presents at its surface (perhaps in consequence of the absorption of the atmospheric oxygen) membranes of a strongly animalized substance, yellowish, stringy, and resembling cheese. These membranes, separated from the rest of ". Chrysophyllum calnito.
the more aqueous liquid, see elastic, almost like caoutchonc ; but they undergo, in time, the same phenomena of putrefaction as gelatine. The people call the coagulum that separates by the contact of the air, cheese. This coagulum grows sour in the space of five or six days, as I observed in the small portions which I carried to Nueva Valencia. The milk contained in a stopped phial, had deposited a little coagulum; and, far from becoming fetid, it exhaled constantly a balsamic odour. The fresh juice mixed with cold water was scarcely coagulated at all ; but on the contact of nitric acid the separation of the viscous membranes took place. We sent two bottles of this milk to M. Fourcroy at Paris: in one it was in its natural state, and in the other, mixed with a certain quantity of carbonate of soda. The French consul residing in the island of St. Thomas, undertook to convey them to him.

The extraordinary tree of which we have been speaking appears to be peculiar to the Cordillera of the coast, particularly from Barbula to the lake of Maracaybo. Some stocks of it exist near the village of San Mateo; and, according to M. Bredemeyer, whose travels have so much enriched the fine conservatories of Schönbrunn and Vienna, in the valley of Caucagua, three days journey east of Caracas. This naturalist found, like us, that the vegetable milk of the palo de vaca had an agreeable taste and an aromatic smell. At Caucagua, the natives call the tree that furnishes this nourishing juice, 'the milk-tree' (arbol del leche). They profess to recognize, from the thickness and colour of the foliage, the trunks that yield the most juice; as the herdsman distinguishes, from external signs, a good milch-cow. No botanist has hitherto known the existence of this plant. It seems, according to M. Kunth, to belong to the sapota family. Long after my return to Europe, I found in the Description of the East Indies by Laet, a Dutch traveller, a passage that seems to have some relation to the cow-tree. "There exist trees," says Laet,*"in the province of Cu-

[^197]mana, the sap of which much resembles curdled milk, and affords a salubrious nuurishment."

Amidst the great number of curious phenomena which I have observed in the course of my travels, I confess there are few that have made so powerful an impression on me as the aspect of the cow-tree. Whatever relates to milk or to corn, inspires an interest which is not merely that of the physical knowledge of things, but is connected with another order of ideas and sentiments. We can scarcely conceive how the human race could exist without farinaceous substances, and without that nourishing juice which the breast of the mother contains, and which is appropriated to the long feebleness of the infant. The amylaceous matter of corn, the object of religious veneration among so many nations, ancient and modern, is diffused in the seeds, and deposited in the roots of vegetables; milk, which serves as an aliment, appears to us exclusively the produce of animal organization. Such are the impressions we have received in our earliest infancy: such is also the source of that astonishment created by the aspect of the tree just described. It is not here the solemn shades of forests, the majestic course of rivers, the mountains wrapped in eternal snow, that excite our emotion. A few drops of vegetable juice recall to our minds all the powerfulness and the fecundity of nature. On the barren flank of a rock grows a tree with coriaceous and dry leaves. Its large woody roots can scarcely penetrate into the stone. For several months of the year not a single shower moistens its foliage. Its branches appear dead and dried; but when the trunk is pierced there flows from it a sweet and nourishing milk. It is at the rising of the sun that this vegetable fountain is most abundant. The negroes and natives are then seen hastening from all quarters, furnished with large bowls to receive the milk, which grows yellow, and thickens at its surface. Some empty their bowls under the tree itself, others carry the juice home to their children.

[^198]In examining the physical properties of animal and vegetable products, science displays them as closely linked together ; but it strips them of what is marvellous, and perhaps, therefore, of a part of their charms. Nothing appears isolated; the chemical principles that were believed to be peculiar to animals are found in plants; a common chain links together all organic nature.

Long before chemists had recognized small portions of wax in the pollen of flowers, the varnish of leaves, and the whitish dust of our plums and grapes, the inhabitants of the Andes of Quindiu made tapers with the thick layer of wax that covers the trunk of a palm-tree.* It is but a few years since we discovered, in Europe, caseum, the basis of cheese, in the emulsion of almonds; yet for ages past, in the mountains of the coast of Venezuela, the milk of a tree, and the cheese separated from that vegetable milk, have been considered as a salutary aliment. How are we to account for this singular course in the development of knowledge? How have the unlearned inhabitants of one hemisphere become cognizant of a fact which, in the other, so long escaped the sagacity of the scientific? It is because a small number of elements and principles differently combined are spread through several families of plants; it is because the genera and species of these natural families are not equally distributed in the torrid, the frigid, and the temperate zones; it is that tribes, excited by want, and deriving almost all their subsistence from the vegetable kingdom, discover nutritive principles, farinaceons and alimentary substances, wherever nature has deposited them in the sap, the bark, the roots, or the fruits of vegetables. That amylaceous fecula which the seeds of the cereal plants furnish in all its purity, is found united with an acrid and sometimes even poisonous juice, in the roots of the arums, the Tacca pinnatifida, and the Jatropha manihot. The savage of America, like the savage of the South Sea islands, has learned to dulcify the fecula, by pressing and separating it from its juice. In the milk of plants, and in the milky emulsions, matter extremely nourishing, albumen, caseum, and sugar, are found mixed with caoutchouc and with deleterious and caustic principles, such as morphine

* Coroxylon andicola.
and hydrocyanic acid.* These mixtures vary not only in the different families, but also in the species which belong to the same genus. Sometimes it is morphine or the narcotic principle, that characterises the vegetable milk, as in some papaverous plants; sometimes it is caoutchouc, as in the hevea and the castilloa; sometimes albumen and caseum, as in the cow-tree.

The lactescent plants belong chiefly to the three families of the euphorbiaceæ, the urticem, and the apocinemt. Since, on examining the distribution of vegetable forms over the globe, we flim that those three families are more numerous in species in the low regions of the tropics, we must thence conclude, that a very elevated temperature contributes to the elaboration of the milky juices, to the formation of caoutchouc, albumen, and caseous matter. The sap of the palo de vaca furnishes unquestionably the most striking example of a vegetable milk in which the acrid and deleterious principle is not united with albumen, caseum, and caoutchouc : the genera euphorbia and asclepias, however, though generally known for their caustic properties, already present us with a few species, the juice of which is sweet and harmless. Such are the Tabayba dulce of the Canary Islands, which we have already mentioned, $\ddagger$ and the Asclepias lactifera of Ceylon. Burman relates that, in the latter country, when cow's milk is wanting, the milk of this asclepias is used; and that the aliments commonly prepared with animal milk are boiled with its leaves. It may be possible, as Decandolle has well observed, that the natives employ only the juice that flows from the young plant, at a period when the acrid principle is not yet developed. In fact, the first shoots of the apocyneous plants are eaten in several countries.

- Opium contains morphine, caoutchouc, \&c.
+ After these three great families follow the papaveraces, the chicoraceæ, the lobeliaceæ, the campanulaceæ, the sapoteæ, and the cucurbitaceæ. The hydrocyanic acid is peculiar to the group of rosaceo-amygdalaces. In the monocotyledonous plants there is no milky juice; but the perisperm of the palms, which yields such sweet and agreeable milky emulsions, contains, no doubt, casetum. Of what nature is the milk of mushrooms?
$\ddagger$ Euphorbia balsamifera. The milly juice of the Cactus mamillaris is equally sweet.

I have endeavoured by these comparisons to bring into consideration, under a more general point of view, the milky juices that circulate in vegetables; and the milky emulsions that the fruits of the amygdalaceous plants and palms yield. I may be permitted to add the result of some experiments which I attempted to make on the juice of the Carica papaya during my stay in the valleys of Aragua, though 1 was then almost destitute of chemical tests. The juice has been since examined by Vauquelin, and this celebrated chemist has very clearly recognized the albumen and caseous matter; he compares the milky sap to a substance strongly animalized,-to the blood of animals; but his researches were confined to a fermented juice and a coagulum of a fæetid smell, formed during the passage from the Mauritius to France. He has expressed a wish that some traveller would examine the milk of the papaw-tree just as it flows from the stem or the fruit.

The younger the fruit of the carica, the more milk it yields : it is even found in the germen scarcely fecundated. In proportion as the fruit ripens, the milk becomes less abundant, and more aqueous. Less of that animal matter which is coagulable by acids and by the absorption of atmospheric oxygen, is found in it. As the whole fruit is viscous,* it might be supposed that, as it grows larger, the coagulable matter is deposed in the organs, and forms a part of the pulp, or the fleshy substance. When nitric acid, diluted with four parts of water, is added drop by drop to the milk expressed from a very young fruit, a very extraordinary phenomenon appears. At the centre of each drop a gelatinous pellicle is formed, divided by greyish streaks. These streaks are simply the juice rendered more aqueous, owing to the contact of the acid having deprived it of the albumen. At the same time, the centre of the pellicles becomes opaque, and of the colour of the yolk of an egg; they enlarge as if by the prolongation of divergent fibres. The whole liquid

[^199]assumes at first the appearance of an agate with milky clouds; and it seems as if organic membranes were forming under the eye of the observer. When the coagulum extends to the whole mass, the yellow spots again disappear. By agitation it becomes granulous like soft cheese.* The yellow colour reappears on adding a few more drops of nitric acid. The acid acts in this instance as the oxygen of the atmosphere at a temperature from $27^{\circ}$ to $35^{\circ}$; for the white coagulum grows yellow in two or three minutes, when exposed to the sun. After a few hours the yellow colour turns to brown, no doubt because the carbon is set more free progressively as the hydrogen, with which it was combined, is burnt. The coagulum formed by the acid becomes viscous, and acquires that smell of wax which I have observed in treating muscular flesh and mushrooms (morels) with nitric acid. According to the fine experiments of Mr. Hatchett, the albumen may be supposed to pass partly to the state of gelatine. The coagulum of the papaw-tree, when newly prepared, being thrown into water, softens, dissolves in part, and gives a yellowish tint to the fluid. The milk, placed in contact with water only, forms also membranes. In an instant a tremulous jelly is precipitated, resembling starch. This phenomenon is particularly striking if the water employed be heated to $40^{\circ}$ or $60^{\circ}$. The jelly condenses in proportion as more water is poured upon it. It preserves a long time its whiteness, only growing yellow by the contact of a few drops of nitric acid. Guided by the experiments of Fourcroy and Vauquelin on the juice of the

* The substance which falls down in grumous and filamentous clots is not pure caoutchouc, but perhaps a mixture of this substance with cascum and albumen. Acids precipitate the caoutchouc from the milky juice of the euphorbiums, fig-trees, and hevea; they precipitate the caseum from the milk of animals? A white coagulum was formed in phials closely stopped, containing the milk of the hevea, and preserved among our collections, during our journey to the Orinoco. It is perhaps the development of a vegetable acid which then furnishes oxygen to the albumen. The formation of the coagulum of the hevea, or of real caoutchouc, is eevertheless much more rapid in contact with the air. The absorption of atmospheric oxygen is not in the least necessary to the production of butter which exists already formed in the milk of animals; but I believe it cannot be doubted that, in the milk of plants, this absorption produces the pellicles of caoutchouc, of coagulated albumen, and of caseum, which are successively formed in vessels exposed to the open arr.
hevea, I mixed a solution of carbonate of soda with the milk of the papaw. No clot is formed, even when pure water is poured on a mixture of the milk with the alkaline solution. The membranes appear only when, by adding am acid, the soda is neutralized, and the acid is in encess $I$ made the coagulum formed by nitric acid, the juice of lemons, or hot water, likewise disappear by mixing it with carbonate of sods. The sap again becomes milky and liquid, as in its primitive state; but this experiment succeeds only when the coagulum has been recently formed.

On comparing the milky juices of the papaw, the cow-treo; and the hevea, there appears a striking analogy between the juices which abound in caseous matter; and those in which caoutchouc prevails. All the white and newly prepared caoutchouc, as well as the waterproof cloaks, manufactured in Spanish America by placing a layer of midk of hevea between two pieces of cloth, exhale an animal and nauseating smell. This seems to indicate that the caoutchouc, in coagulating, carries with it the caseum, which is perhaps only an altered albumen.
The produce of the bread-fruit tree can no more be considered as bread than plantains before the state of maturity, or the tuberous and amylaceous roots of the cassava, the dioscorea, the Convolvulus batatas, and the potato. The milk of the cow-tree contains, on the contrary, a caseous matter, like the milk of mammiferous animals. Advancing to more general considerations, we may regard, with M. Gay-Lussac, the caoutchouc as the oily part,the butter of vegetable milk. We find in the milk of plants caseum and caoutchouc; in the milk of animals, caseum and butter. The proportions of the two albuminous and oily principles differ in the various species of animals. and of lactescent plants. In these last they are most frequently mixed with other substances hurtful as food; but of which the separation might perhaps be obtained by chemical processes. A vegetable milk becomes nourishing when it is destitute of acrid and narcotic principles; and abounds less in caoutchoue than in caseous matter.*

[^200]Whilst the palo de vaca manifests the immense fecundity and the bounty of nature in the torrid zone, it also reminds us of the numerous causes which favour in those fine climates the careless indolence of man. Mungo Park has made known the butter-tree of Bambarra, which M. De Candolle suspects to be of the family of sapotas, as well as our milk-tree. The plantain, the sago-tree, and the mauritia of the Orinoco, are as much bread-trees as the rema of the South Sea. The fruits of the crescentia and the lecythis serve as vessels for containing food, while the spathes of the palms, and the bark of trees, furnish caps and garments without a seam. The knots, or rather the interior cells of

Boainon-Lagrange, and Vauquelin (Annales de Chimie, vol. xlvi, vol. li, vol. lxxix, vol. lxxx, vol. lexxv, have pointed out a great quantity of atbumen in the substance of the Agaricus deliciosus, an edible mushroom. It is this albumen contained in their juice which renders them so hard when boiled. It has been proved that morels (Morchella esculenta) can be converted into sebaceous and adipocerous matter, capable of being used in the fabrication of soap. (De Candolle, sur les Propriétés médicinales des Plantes.) Saccharine matter has also been found in mushrooms by Gunther. It is in the family of the fungi, more especially in the clavariæ, phalli, helvetix, the merulii, and the small gymnopæ which display themselves in a few hours after a storm of rain, that organic nature produces with most rapidity the greatest variety of chemical principles-sugar, albumen, adipocire, acetate of potash, fat, ozmazome, the aromatic principles, \&c. It would be interesting to examine, besides the milk of the lactescent fungi, those species which, when cut in pieces, change their colour on the contact of atmospheric air.

Though we have referred the palo de vaca to the family of the sapotas, we have nevertheless found in it a great resemblance to some plants of the urticeous kind, especially to the fig-tree, because of its terminal stipulse in the shape of a horn; and to the brosimum, on account of the structure of its fruit. M. Kunth would even have preferred this last classification ; if the description of the fruit, made on the spot, and the nature of the milk, which is acrid in the urticees, and sweet in the sapotas, did not seem to confirm our conjecture. Bredemeyer saw, like us, the fruit, and not the flower of the cow-tree. He asaerts that he observed [sometimes ?] two seeds, lying one against the other, as in the alligator peartree (Laurus persea). Perhaps this botanist had the intention of exp pressing the same conformation of the nucleus that Swartz indicates in the description of the brosimum : -"nucleus bilobus aut bipartibilis." We have mentioned the places where this remarkable tree grows: it will be eary for botanical travellers to procure the flower of the palo de vaca; and to remove the doubts which atill remain, of the family to which it bolongs.
the trunks of bamboos, supply ladders, and facilitate in a thousand ways the construction of a hut, and the fabrication of chairs, beds, and other articles of furniture that compose the wealth of a savage household. In the midst of this lavish vegetation, so varied in its productions, it requires very powerful motives to excite man to labour, to rouse him from his lethargy, and to unfold his intellectual faculties.

Cacao and cotton are cultivated at Barbula. We there found, what is very rare in that country, two large cylindrical machines for separating the cotton from its seed; one put in motion by an hydraulic wheel, and the other by a wheel turned by mules. The overseer of the farm, who had constructed these machines, was a native of Merida. He was acquainted with the road that leads from Nueva Valencia, by the way of Guanare and Misagual, to Varinas; and thence by the ravine of Collejones, to the Paramo de Mucuchies and the mountains of Merida covered with eternal snows. The notions he gave us of the time requisite for going from Valencia by Varinas to the Sierra Nevada, and thence by the port of Torunos, and the Rio Santo Domingo, to San Fernando de Apure, were of infinite value to us. It can scarcely be imagined in Europe, how difficult it is to obtain accurate information in a country where the communications are so rare; and where distances are diminished or exaggerated according to the desire that may be felt to encourage the traveller, or to deter him from his purpose. I had resolved to visit the eastern extremity of the Cordilleras of New Grenada, where they lose themselves in the paramos of Timotes and Niquitao. I learned at Barbula, that this excursion would retard our arrival at the Orinoco thirty-five days. This delay appeared to us so much the longer, as the rains were expected to begin sooner than usual. We had the hope of examining afterwards a great number of mountains covered with perpetual snow, at Quito, Peru, and Mexico; and it appeared to me still more prudent to relinquish our project of visiting the mountains of Merida, since by so doing we might miss the real object of our journey, that of ascertaining by astronomical observations the point of communication between the Orinoco, the Rio Negro, and the river Amazon. We returned in consequence from Barbula to Guacara, to take leave of the family of the

Marquis del Toro, and pass three days more on the borders of the lake.

It was the carnival season, and all was gaiety. The sports in which the people indulge, and which are called carnes tollendas,* assume occasionally somewhat of a savage character. Some led an ass loaded with water, and, whereever they found a window open, inundated the apartment within by means of a pump. Others carried bags filled with hairs of picapica; ; and blew the hair, which causes a great irritation of the skin, into the faces of those who passed by.

From Guacara we returned to Nueva Valencia. We found there a few French emigrants, the only ones we saw during five years passed in the Spanish colonies. Notwithstanding the ties of blood which unite the royal families of France and Spain, even French priests were not permitted to take refuge in that part of the New World, where man with such facility finds food and shelter. Beyond the Atlantic, the United States of America afford the only asylum to misfortune. A government, strong because it is free, confiding because it is just, has nothing to fear in giving refuge to the proscribed.

We have endeavoured above to give some notions of the state of the cultivation of indigo, cotton, and sugar, in the province of Caracas. Before we quit the valley of Aragua and its neighbouring coast, it remains for us to speak of the cacao-plantations, which have at all times been considered as the principal source of the prosperity of those countries. The province of Caracas, $\ddagger$ at the end of the eighteenth century, produced annually a hundred and fifty thousand fanegas, of which a hundred thousand were consumed in Spain, and thirty thousand in the province. Estimating a fanega of cacao at only twenty-five piastres for the price given at Cadiz, we find that the total value of the exportation of cacao, by the six ports of the Capitania General of

[^201]Caracas, amounts to four million eight hundred thousand piastres. So important an object of commerce merits a careful discussion; and I flatter myself, that; from the great number of materials I have collected on all the branches of colonial agriculture, I shali be able to add something to the information published by M. Depons, in his valuable work on the provinces of Venezuela.

The tree which produces the cacao is not at present found wild in the forests of Terra Firma to the north of the Orinoco; we began to find it only beyond the cataracts of Ature and Maypure. It abounds particularly near the banks of the Ventuari, and on the Upper Orinoco, between the Padamo and the Gehette. This scarcity of wild cacaotrees in South America, north of the latitude of $6^{\circ}$, is a very curious phenomenon of botanical geography, and yet little known. This phenomenon appears the more surprising, as, according to the annual produce of the harvest, the number of trees in full bearing in the cacao-plantations of Caracas, Nueva Barcelona, Venezuela, Varinas, and Maracaybo, is estimated at more than sixteen millions. The wild cacaotree has many branches, and is covered with a tufted and dark foliage. It bears a very small fruit, like that variety which the ancient Mexicans called tlalcacahuatl. Transplanted into the conucos of the Indians of Cassiquiare and the Rio Negro, the wild tree preserves for several generations that force of vegetable life, which makes it bear fruit in the fourth year; while, in the province of Caracas, the harvest begins only the sixth, seventh, or eighth year. It is later in the inland parts than on the coasts and in the valley of Guapo. We met with no tribe on the Orinoco that prepared a beverage with the seeds of the cacao-tree. The savages suck the pulp of the pod, and throw away the seeds, which are often found in heaps where they have passed the night. Though chorote, which is a very weak infusion of cacao, is considered on the coast to be a very ancient beverage, no historical fact proves that chocolate, or any preparation whatever of cacao, was known to the natives of Venezuela before the arrival of the Spaniards. It appears to me more probable that the cacao-plantations of Caracas were suggested by those of Mexico and Guatimala ; and that the Spaniards inhabiting Terra Firma learned the
caltivation of the cacao-tree, sheltemed in its youth by the foliage of the erythrina and plantain;* the fabrication of cakes of chocolatl, and the use of the liquid of the same name, in course of their communications with Mexieo; Guatimala, and Nicaragua.

Down to the sisteenth century travellers differed in opimion respecting the chocolatl. Bensoni plainly says that it is a drink "fitter for hogs than men." $\dagger$ The Jesuit Acosta asserts, that "the Spaniards who inhabit America are fond of chocolate to excess; but that it requires to be accustomed to that black beverage not to be disgusted at the mere sight of its froth, which swims on it like yeast on a fermented liquor." He adds, "the cacao is a prejudice (una supersticion) of the Mexicans, as the coca is a prejudice of the Peruvians." These opinions remind us of Madame de Sevigne's prediction respecting the use of coffee. Fernando Cortez and his page, the gentilhombre del gran Conquistador, whose memoirs were published by Ramusio, on the contrary, highly praise chocolate, not only as an agreeable drink, though prepared cold, $\ddagger$ but in particular as a nutritious substance. "He who has drunk one cup," says the page of Fernando Cortez, "can travel a whole day without any other food, especially in very hot climates; for chocolate is by its nature cold and refreshing." We shall not subscribe to the latter part of this assertion; but we shall soon have occasion, in our voyage on the Orinoco, and our excursions towards the summit of the Cordilleras, to celebrate the salutary properties of chocolate. It is easily conveyed and readily employed: as an aliment it contains a large quantity of nutritive and stimulating particles in a small compass. It has been said with truth, that in the East, rice, gum, and ghee (clarified butter), assist man in crossing the deserts; and so, in the New World, cho-
*This process of the Mexican cultivators, practised on the cosst of Caracas, is described in the memoirs known under the title of "Relagione di certo Gentiluomo del Signor Cortez, Conquistadore del Messico." (Ramusio, tom. ii, p. 134).
$\dagger$ Benzoni, Istoria del Mondo Nuovo, 1572, p. 104.
$\pm$ Father Gili has very clearly shown, from two passages in Torquemada (Monarquia Indiana, lib. xiv.) that the Mexicans prepared the infusion cold, and that the Spaniards introduced the custom of prepariag chocolate by boiling water with the paste of cacao.
colate and the flour of maize, have rendered accessible to the traveller the table-lands of the Andes, and vast uninhabited forests.

The cacao harvest is extremely variable. The tree vegetates with such vigour that flowers spring out even from the roots, wherever the earth leaves them uncovered. It suffers from the north-east winds, even when they lower the temperature only a few degrees. The heavy showers that fall irregularly after the rainy season, during the winter months, from December to March, are also very hurtful to the cacao-tree. The proprietor of a plantation of fifty thousand trees often loses the value of more than four or five thousand piastres in cacao in one hour. Great humidity is favourable to the tree only when it augments progressively, and is for a long time uninterrupted. If, in the season of drought, the leaves and the young fruit be wetted by a violent shower, the fruit falls from the stem; for it appears that the vessels which absorb water break from being rendered turgid. Besides, the cacao-harvest is one of the most uncertain, on account of the fatal effects of inclement seasons, and the great number of worms, insects, birds, and quadrupeds,* which devour the pod of the cacao-tree; and this branch of agriculture has the disadvantage of obliging the new planter to wait eight or ten years for the fruit of his labours, and of yielding after all an article of very difficult preservation.

The finest plantations of cacao are found in the province of Caracas, along the coast, between Caravalleda and the mouth of the Rio Tocuyo, in the valleys of Caucagua, Capaya, Curiepe, and Guapo; and in those of Cupira, between cape Conare and cape Unare, near Aroa, Barquesimeto, Guigue, and Uritucu. The cacao that grows on the banks of the Uritucu, at the entrance of the llanos, in the jurisdiction of San Sebastian de las Reyes, is considered to be of the finest quality. Next to the cacao of Uritucu comes that of Guigue, of Caucagua, of Capaya, and of Cupira. The merchants of Cadiz assign the first rank to the cacao of Caracas, immediately after that of Socomusco; and its price is generally from thirty to forty per cent. higher than that of Guayaquil.

[^202]It is only since the middle of the seventeenth century, when the Dutch, tranquil possessors of the island of Curaçoa, amakened, by their smuggling, the agricultural industry of the inhabitants of the neighbouring coasts, that cacao has become an object of exportation in the province of Caracas. We are ignorant of everything that passed in those countries before the establishment of the Biscay Company of Guipuzcoa, in 1728. No precise statistical data have reached us: we only know that the exportation of cacao from Caracas scarcely amounted, at the beginning of the eighteenth century, to thirty thousand fanegas a-year. From 1730 to 1748 , the company sent to Spain eight hundred and fifty-eight thousand nine hundred and seventyeight fanegas, which make, on an average, forty-seven thousand seven hundred fanegas a-year; the price of the fanega fell, in 1732, to forty-five piastres, when it had before kept at eighty piastres. In 1763 the cultivation had so much augmented, that the exportation rose to eighty thousand six hundred and fifty-nine fanegas.
In an official document, taken from the papers of the minister of finance, the annual produce (la cosecha) of the province of Caracas is estimated at a hundred and thirtyfive thousand fanegas of cacao; thirty-three thousand of which are for home consumption, ten thousand for other Spanish colonies, seventy-seven thousand for the mothercountry, fifteen thousand for the illicit commerce with the French, English, Dutch, and Danish colonies. From 1789 to 1793, the importation of cacao from Caracas into Spain was, on an average, seventy-seven thousand seven hundred and nineteen fanegas a-year, of which sixty-five thousand seven hundred and sixty-six were consumed in the country, and eleven thousand nine hundred and fifty-three exported to France, Italy, and Germany.
The late wars have had much more fatal effects on the cacao trade of Caracas than on that of Guayaquil. On account of the increase of price, less cacao of the first quality has been consumed in Europe. Instead of mixing, as was done formerly for common chocolate, one quarter of the саса of Caracas, with three-quarters of that of Guayaquil, the latter has been employed pure in Spain. We must here
remark, that a great deal of cacao of an inferior quality, such as that of Marañon, the Rio Negro, Honduras, and the island of St. Lucia, bears the name, in commerce, of Guayaquil cacao. The exportation from that port amounts only to sixty thousand fanegas; consequently it is two thirds less than that of the ports of the Capitania-General of Caracas.

Though the plantations of cacao have augmented in the provinces of Cumana, Barcelona, and Maracaybo, in proportion as they have diminished in the province of Caracas, it is still believed that, in general, this ancient branch of agricultural industry gradually declines. In many parts coffee and cotton-trees progressively take place of the cacao, of which the lingering harvests weary the patience of the cultivator. It is also asserted, that the new plantations of cacao are less productive than the old; the trees do not acquire the same vigour, and yield later and less abundant fruit. The soil is still said to be exhausted; but probably it is rather the atmosphere that is changed by the progress of clearing and cultivation. The air that reposes on a virgin soil covered with forests is loaded with humidity and those gaseous mixtores that serve for the nutriment of plants, and arise from the decomposition of arganic substances. When a country has been long subjected to cultivation, it is not the proportions between the azote and oxygen that vary. The constituent bases of the atmosphere remain onaltered; but it no longer contains, in a state of suspension, those binary and ternary mixtures of carbon, hydrogen, and nitrogen, which a virgin soil exhales, and which are regarded as a source of fecundity. The air, purer and less charged with miasmata and heterogeneous emanations, becomes at the same time drier. The elasticity of the vapours undergoes a sensible diminution. On land long cleared, and consequently little favourable to the cultivation of the cacao-tree (as, for instance, in the West India Islands), the fruit is almost as small as that of the wild cacao-tree. It is on the banks of the Upper Orinoco, after having crossed the Llanos, that we find the true country of the cacao-tree; thick forests, in which, on a virgin soil, and surrounded by an atmosphere continually humid, the trees furnish, from

Original from
the fourth year, abundant crops. Wherever the soil is not exhausted, the fruit has become by cultivation larger and bitter, but also later.
On seeing the produce of cacao gradually diminish in Terra Firma, it may be inquired, whether the consumption will diminish in the same proportion in Spain, Italy, and the rest of Europe; or whether it be not probable, that by the destruction of the cacao plantations, the price will augment. sufficiently to rouse anew the industry of the cultivator. This latter opinion is generally admitted by those who deplore, at Caracas, the diminution of so ancient and profitable a branch of commerce. In proportion as civilization extends towards the humid forests of the interior, the banks of the Orinoco and the Amazon, or towards the valleys that furrow the eastern declivity of the Andes, the new planters will find lands and an atmosphere equally favourable to the culture of the cacao-tree.
The Spaniards, in general, dislike a mixture of vanilla with the cacmo, as irritating the nervous system; the fruit, therefore, of that orchideous plant is entirely neglected in the province of Caracas, though abundant crops of it might be gathered on the moist and feverish coast between Porto Cabello and Ocumare; especially at Turiamo, where the fruits of the Epidendrum vanilla attain the length of eleven or twelve inches. The English and the Anglo-Americans often seek to make purchases of vanilla at the port of La Guayra, but the merchants procure with difficulty a very small quantity. In the valleys that descend from the chain of the coast towards the Caribbean Sea, in the province of Truxillo, as well as in the Missions of Guiana, near the cataracts of the Orinoco, a great quantity of vanilla might be collected; the produce of which would be still more abundant, if, according to the practice of the Mexicans, the plant were disengaged, from time to time, from the creeping plants by which it is entwined and stifled.

The hot and fertile valleys of the Cordillera of the coast of Venezuela occupy a tract of land which, on the west, towards the lake. of Maracaybo, displays a remarkable variety of 'scenery. I shall exhibit in one view, to close this chapter, the facts I have been able to collect respecting
the quality of the soil and the metallic riches of the districts of Aroa, of Barquesimeto, and of Carora.

From the Sierra Nevada of Merida, and the paramos of Niquitao, Bocono, and Las Rosas,* which contain the valuable bark-tree, the eastern Cordillera of New Granada $\dagger$ decreases in height so rapidly, that, between the ninth and tenth degrees of latitude, it forms only a chain of little mountains, which, stretching to the north-east by the Altar and Torito, separates the rivers that join the Apure and the Orinoco from those numerous rivers that flow either into the Caribbean Sea or the lake of Maracaybo. On this dividing ridge are built the towns of Nirgua, San Felipe el Fuerte, Barquesimeto, and Tocuyo. The first three are in a very hot climate; but Tocuyo enjoys great coolness, and we heard with surprise, that, beneath so fine a sky, the inhabitants have a strong propensity to suicide. The ground rises towards the south; for Truxillo, the lake of Urao, from which carbonate of soda is extracted, and La Grita, all to the east of the Cordillera, though no farther distant, are four or five hundred toises high.

On examining the law which the primitive strata of the Cordillera of the coast follow in their dip, we believe we recognize one of the causes of the extreme humidity of the land bounded by this Cordillera and the ocean. The dip of the strata is most frequently to the north-west; so that the waters flow in that direction on the ledges of rock; and form, as we have stated above, that multitude of torrents and rivers, the inundations of which become so fatal to the

* Many travellers, who were monks, have asserted that the little Paramo de Las Rosas, the height of which appears to be more than 1,600 toises, is covered with rosemary, and the red and white roses of Europe grow wild there. These roses are gathered to decorate the altars in the neighbouring villages on the festivals of the church. By what accident has our Rosa centifolia become wild in this country, while we nowhere found it in the Andes of Quito and Peru? Can it really be the rose-tree of our garden?
$\dagger$ The bark exported from the port of Maracaybo does not come from the territory of Venezuela, but from the mountains of Pamplona in New Grenada, being brought down the Rio de San Faustino, that flows into the lake of Maracaybo. (Pombo, Noticias sobre las Quinas, 1814, p. 65.) Some is collected near Merida, in the ravine of Viscucucuy.
health of the inhabitants, from cape Codera as far as the lake of Maracaybo.
Among the rivers which descend north-east toward the coast of Porto Cabello, and La Punta de Hicacos, the most remarkable are those of Tocuyo, Aroa, and Yaracuy. Were it not for the miasmata which infect the atmosphere, the valleys of Aroa and of Yaracuy would perhaps be more populous than those of Aragua. Navigable rivers would even give the former the advantage of facilitating the exportation of their own crops of sugar and cacao, and that of the productions of the neighbouring lands; as the wheat of Quibor, the cattle of Monai, and the copper of Aroa. The mines from which this copper is extracted, are in a lateral valley, opening into that of Aroa; and which is less hot, and less unhealthy, than the ravines nearer the sea. In the latter the Indians have their gold-washings, and the soil conceals rich copper-ores, which no one has yet attempted to extract. The ancient mines of Aroa, after having been long neglected, have been wrought anew by the care of Don Antonio Henriquez, whom we met at San Fernando on the borders of the Apure. The total produce of metallic copper is twelve or fifteen hundred quintals a year. This copper, known at Cadiz by the name of Caracas copper, is of excellent quality. It is even preferred to that of Sweden, and of Coquimbo in Chile. Part of the copper of Aroa is employed for making bells, which are cast on the spot. Some ores of silver have been recently discovered between Aroa and Nirgua, near Guanita, in the mountain of San Pablo. Grains of gold are found in all the mountainous lands between the Rio Yaracuy, the town of San Felipe, Nirgua, and Barquesimeto; particularly in the Rio de Santa Cruz, in which the Indian gold-gatherers have sometimes found lumps of the value of four or five piastres. Do the neighbouring rocks of mica-slate and gneiss contain veins? or is the gold disseminated here, as in the granites of Guadarama in Spain, and of the Fichtelberg in Franconia, throughout the whole mass of the rock? Possibly the waters, in filtering through it, bring together the disseminated grains of gold; in which case every attempt to work the rock would be useless. In the Savana de la Miel, near the town of Barquesimeto, a shaft has been sunk in a black shining slate resembling vol. II. F
ampelite. The minerals extracted from this shaft, which were sent to me at Caracas, were quartz; non-auriferous pyrites, and carbonated lead, crystallized in needles of a silky lustre.

In the early times of the conquest the working of the mines of Nirgua and of Buria* was begun, notwithstanding the incursions of the warlike nation of the Giraharas. In this very district the accumulation of negro slaves in 1553 gave rise to an event bearing some analogy to the insurrection in St. Domingo. A negro slave excited an insurrection among the miners of the Real de San Felipe de Buria. He retired into the woods, and founded, with two hundred of his companions, a town, where he was proclaimed king. Miguel, this new king, was a friend to pomp and parade. He caused his wife Guiomar, to assume the title of queen; and, according to Oviedo, he appointed ministers and counsellors of state, officers of the royal household, and even a negro bishop. He soon after ventured to attack the neighbouring town of Nueva Segovia de Barquesimeto; but, being repulsed by Diego de Losada, he perished in the conflict. This African monarchy was succeeded at Nirgua by a republic of Zamboes, the descendants of negroes and Indians. The whole municipality (cabildo) is composed of men of colour to whom the king of Spain has given the title of "his faithful and loyal subjects, the Zamboes of Nirgua." Few families of Whites will inhabit a country where the system of government is so adverse to their pretensions; and the little town is called in derision La república de Zambos y Mulatos.

If the hot vallies of Aroa, of Yaracuy, and of the Rio Tocuyo, celebrated for their excellent timber, be rendered feverish by luxuriance of vegetation, and extreme atmospheric humidity, it is different in the savannahs of Monai and Carora. These Llanos are separated by the mountainous tract of Tocuyo and Nirgua from the great plains of La Portuguesa and Calabozo. It is very extraordinary to see barren savannahs loaded with miasmata. No marshy ground is found there, but several phenomena indicate a

[^203]sisengagement of hydrogen.* When travelleas, who are not acquainted with natural inflammable gases, are shown the Cueva del Serrito de Monai, the people of the country love to frighten them by setting fire to the gaseous combination which is constantly accumulated in the upper part of the cavern. May we attribute the insalubrity of the atmosphere to the same causes as those which operate in the plains between Tivoli and Rome, viz., disengagements of sulphuretted $\cdot$ hydrogen? $\dagger$ Possibly, also, the mountainous lands, near the llanos of Monai, may have a baneful influerice on the surrounding plains. The south-easterly winds may convey to them the patrid exhalations that rise from the ravine of Villegas, and from La Sienega de Cabra, between Carora and Carache. I am desirous of collecting every circumstance having a relation to the salubrity of the air; for, in a matter so obscure, it is only by the comparison of a great number of phenomena, that we can hope to discover the truth.
The barren yet feverish savannahs, extending from Barquesimeto to the eastern shore of the lake of Maracaybo, are partly covered with cactus; but the good silvester-cochineal, known by the vague name of grana de Carora, comes from a more temperate region, between Carora and Truxillo, and

* What is that luminous phenomenon known under the name of the Lantern (farol) of Maracaybo, which is perceived every night toward the seaside as well as in the inland parts, at Merida for example, where M. Palacios observed it during two years? The distance, greater than 40 leagues, at which the light is observed, has led to the supposition that it might be owing to the effects of a thunderstorm, or of electrical explosions which might daily take place in a pass in the mountains. It is asserted that, on approaching the farol, the rolling of thunder is heard. Others vaguely allege that it is an air-volcano, and that asphaltic soils, like those of Mena, cause these inflammable exhalations which are so constant in their appearance. The phenomenon is observed on a mountrinous and uninhabited spot, on the borders of the Rio Catatumbo, near its junction with the Rio Sulia. The situation of the farol is such that, being nearly in the meridian of the opening (boca) of the lake of Maracaybo, navigators are guided by it as by a lighthouse.
$\dagger$ Don Carlos del Pozo has discovered in this district, at the bottom of the Quebrada de Moroturo, a stratum of clayey earth, black, strongly soiling the fingers, emitting a powerful smell of sulphur, and inflaming spontaneously when slightly moistened and exposed for a long time to the rays of the tropical sun. The detonation of this muddy sabstance is very violent.
particularly from the valley of the Rio Mucuju,* to the east of Merida. The inhabitants altogether neglect this production, so much sought for in commerce.


## Chapter XVII.

Mountains which separate the Valleys of Aragua from the Llanos of Caracas.-Villa de Cura.-Parapara.-Llanos or Steppes.-Calabozo.

The chain of mountains, bordering the lake of Tacarigua towards the south, forms in some sort the northern shore of the great basin of the Llanos or savannahs of Caracas. To descend from the valleys of Aragua into these savannahs, it is necessary to cross the mountains of Guigue and of Tucutunemo. From a peopled country embellished by cultivation, we plunge into a vast solitude. Accustomed to the aspect of rocks, and to the shade of valleys, the traveller beholds with astonishment these savannahs without trees, these immense plains, which seem to ascend to the horizon.

Before I trace the scenery of the Llanos, or of the region of pasturage, I will briefly describe the road we took from Nueva Valencia, by Villa de Cura and San Juan, to the little village of Ortiz, at the entrance of the steppes. We left the valleys of Aragua on the 6th of March before sunrise. We passed over a plain richly cultivated, keeping along the south-west side of the lake of Valencia, and crossing the ground left uncovered by the waters of the lake. We were never weary of admiring the fertility of the soil, covered with calabashes, water-melons, and plantains. The rising of the sun was announced by the distant noise of the howling monkeys. Approaching a group of trees, which rise in the midst of the plain, between those parts which were anciently the islets of Don Pedro and La Negra, we saw numerous bands of araguatos moving as in procession and very slowly, from one tree to another. A male was followed by a great number of females; several of the latter carrying

[^204]their young on their shoulders. The howling monkeys, which live in society in different parts of America, everym where resemble each other in their manners, though the species are not always the same. The uniformity with which the araguatos* perform their movements is extremely striking. Whenever the branches of neighbouring trees do not touch each other, the male who leads the party suspends himself by the callous and prehensile part of his tail; and, letting fall the rest of his body, swings himself till in one of his oscillations he reaches the neighbouring branch. The whole file performs the same movements on the same spot. It is almost superfluous to add how dubious is the assertion of Ulloa, and so many otherwise wellinformed travellers, according to whom, the marimondos, $\dagger$ the araguatos, and other monkeys with a prehensile tail, form a sort of chain, in order to reach the opposite side of a river. $\ddagger$ We had opportunities, during five years, of observing thousands of these animals; and for this very reason we place no confidence in statements possibly invented by the Europeans themselves, though repeated by the Indians of the Missions, as if they had been transmitted to them by their fathers. Man, the most remote from civilization, enjoys the astonishment he excites in recounting the marvels of his country. He says he has seen what he imagines may have been seen by others. Every savage is a hunter, and the stories of hunters borrow from the imagination in proportion as the animals, of which they boast the artifices, are endowed with a high degree of intelligence. Hence arise the fictions of which foxes, monkeys, crows, and the condor of the Andes, have been the subjects in both hemispheres.

The araguatos are accused of sometimes abandoning their young, that they may be lighter for flight when pursued by the Indian hunters. It is said that mothers have been seen removing their young from their shoulders, and throwing them down to the foot of the tree. I am inclined to believe that a movement merely accidental has been mistaken for

[^205]one premeditated. The Indisns have a dislike and a predilection for certain races of monkeys; they love the vinditas, the titis, and generally all the little sagoins; while the araguatos, on account of their mournful aspect, and their uniform howling, are at once detested and abused. In reflecting on the causes that may facilitate the propagation of sound in the air during the night, I thought it important to determine with precision the distance at which, especially in damp and stormy weather, the howling of a band of aragustos is heard. I believe I obtained proof of its being distinguished at eight hundred toises distance. The monkeys which are furnished with four hands cannot make excursions in the Llanos; and it is easy, amidst vast plains covered with grass, to recognize a solitary group of trees, whence the noise proceeds, and which is inhabited by howling monkeys. Now, by approaching or withdrawing from this group of trees, the maximum of the distance may be measured, at which the howling is heard. These distances appeared to me sometimes one-third greater during the night, especially when the weather was cloudy, very hot, and humid.

The Indians pretend that when the araguatos fill the forests with their howling, there is always one that chaunts as leader of the chorus. The observation is pretty accurate. During a long interval one solitary and strong voice is generally distinguished, till its place is taken by another voice of a different pitch. We may observe from time to time the same instinct of imitation among frogs, and almost all animals which live together and exert their voices in union. The Missionaries further assert, that, when a female among the araguatos is on the point of bringing forth, the choir suspends its howlings till the moment of the birth of the young. I could not myself judge of the accuracy of this assertion; but I do not believe it to be entirely unfounded. I have observed that, when an extraordinary incident, the moans for instance of a wounded araguato, fixed the attention of the band, the howlings were for some minutes suspended. Our guides assured us gravely, that, "to cure an asthma, it is sufficient to drink out of the bony drum of the hyoidal bone of the araguato." This animal having so extraordinary a volume of voice, it is supposed that ita
laryux must necessarily impart to the water poured into it the virtue of curing affections of the lungs. Such is the science of the vulgar, which sometimes resembles that of the ancients.

We passed the night at the village of Guigue, the latitude of which I found by observations of Canopus to be $10^{\circ} 4^{\prime}$ $11^{\prime \prime}$. The village, surrounded with the richest cultivation, is only a thousand toises distant from the lake of Tacarigua. We lodged with an old sergeant, a native of Murcia, a man of a very original character. To prove to us that he had stadied among the Jesuits, he recited the history of the creation of the world in Latin. He knew the names of Augustus, Tiberius, and Diocletian; and while enjoying the agreeable coolness of the nights in an enclosure planted with bananas, he employed himself in reading all that related to the courts of the homan emperors. He inquired of us with earnestness for a remedy for the gout, from which he suffered severely. "I know," said he, "a Zambo of Valencia, a famous curioso, who could cure me; but the Zambo would expect to be treated with attentions which I cannot pay to a man of his colour, and I prefer remaining as I am."
On leaving Guigue we began to ascend the chain of mountains, extending on the south of the lake towards Guacimo and La Palma. From the top of a table-land, at three hundred and twenty toises of elevation, we saw for the last time the valleys of Aragua. The gneiss appeared uncovered, presenting the same direction of strata, and the same dip towards the north-west. Veins of quartz, that traverse the gneiss, are auriferous; and hence the neighbouring ravine bears the name of Quebrada del Oro. We heard with surprise at every step the name of "ravine of gold," in a country where only one single mine of copper is wrought. We travelled five leagues to the village of Maria Magdalena, and two leagues more to the Villa de Cura. It was Sunday, and at the village of Maria Magdalena the inhabitants were assembled before the church. They wanted to force our muleteers to stop and hear mass. We resolved to remain; but, after a long altercation, the muleteers pursued their way. I may observe, that this is the only dispute in which we became engaged from such a cause. Very erroneous ideas
are formed in Europe of the intolerance, and even of the religious fervour of the Spanish colonists.

San Luis de Cura, or, as it is commonly called, the Villa de Cura, lies in a very barren valley, running north-west and south-east, and elevated, according to my barometrical observations, two hundred and sixty-six toises above the level of the ocean. The country, with the exception of some fruittrees, is almost destitute of vegetation. The dryness of the plateau is the greater, because (and this circumstance is rather extraordinary in a country of primitive rocks) several rivers lose themselves in crevices in the ground. The Rio de Las Minas, north of the Villa de Cura, is lost in a rock, again appears, and then is ingulphed anew without reaching the lake of Valencia, towards which it flows. Cura resembles a village more than a town. We lodged with a family who had excited the resentment of government during the revolution at Caracas in 1797. One of the sons, after having languished in a dungeon, had been sent to the Havannah, to be imprisoned in a strong fortress. With what joy his mother heard that after our return from the Orinoco, we should visit the Havannah! She entrusted me with five piastres, "the whole fruit of her savings." I earnestly wished to return them to her; but I feared to wound her delicacy, and give pain to a mother, who felt a pleasure in the privations she imposed on herself. All the society of the town was assembled in the evening, to admire in a magic lantern views of the great capitals of Europe. We were shown the palace of the Tuileries, and the statue of the Elector at Berlin.

An apothecary who had been ruined by an unhappy propensity for working mines, accompanied us in our excursion to the Serro de Chacao, very rich in auriferous pyrites. We continued to descend the southern declivity of the Cordillera of the coast, in which the plains of Aragua form a longitudinal valley. We passed a part of the night of the 11 th of March at the village of San Juan, remarkable for its thermal waters, and the singular form of two neighbouring mountains, called the Morros of San Juan. They form slender peaks, which rise from a wall of rocks with a very extensive base. The wall is perpendicular, and resembles
the Devil's Wall, which surrounds a part of the group of mountains in the Hartz.* These peaks, when seen from afar in the Llanos, strike the imagination of the inhabitants of the plain, who are not accustomed to the least unequal ground, and the height of the peaks is singularly exaggerated by them. They were described to us as being in the middle of the steppes (which they in reality bound on the north) far beyond a range of hills called La Galera. Judging from angles taken at the distance of two miles, these hills are scarcely more than a hundred and fifty-six toises higher than the village of San Juan, and three hundred and fifty toises above the level of the Llanos, The thermal waters glide out at the foot of these hills, which are formed of transition-limestone. The waters are impregnated with sulphuretted hydrogen, like those of Mariara, and form a little pool or lagoon, in which the thermometer rose only to $31 \cdot 3^{\circ}$. I found, on the night of the 9th of March, by very satisfactory observations of the stars, the latitude of Villa de Cura to be $10^{\circ} 2^{\prime} 47^{\circ}$.

The Villa de Cura is celebrated in the country for the miracles of an image of the Virgin, known by the name of Nuestra Señora de los Valencianos. This image was found in a ravine by an Indian, about the middle of the eighteenth century, when it became the object of a contest between the towns of Cura and San Sebastian de los Reyes. The vicars of the latter town asserting that the Virgin had made her first appearance on the territory of their parish, the Bishop of Caracas, in order to put an end to the scandal of this long dispute, caused the image to be placed in the archives of his bishopric, and kept it thirty years under seal. It was not restored to the inhabitants of Cura till 1802.

After having bathed in the cool and limpid water of the little river of San Juan, the bottom of which is of basaltic grünstein, we continued our journey at two in the morning, by Ortiz and Parapara, to the Mesa de Paja. The road to the Llanos being at that time infested with robbers, several travellers joined us so as to form a sort of caravan. We proceeded down hill during six or seven hours; and we skirted the Cerro de Flores, near which the road turns off,

[^206]leading to the great village of San Jose de Tisnao. We passed the farms of Luque and Juncalito, to enter the valleys which, on account of the bad road, and the blue colour of the slates, bear the names of Malpaso and Piedras Azules.
This ground is the ancient shore of the great basin of the steppes, and it furnishes an interesting subject of research to the geologist. We there find trap-formations, probably more recent than the veins of diabasis near the town of Caracas, which seem to belong to the rocks of igneous formation. They are not long and narrow streams as in Auvergne, but large sheets, streams that appear like real strata. The lithoid masses here cover, if we may use the expression, the shore of the ancient interior sea; everything subject to destruction, such as the liquid dejections, and the scorim filled with bubbles, has been carried away. These phenomena are particularly worthy of attention on account of the close affinities observed between the phonolites and the amygdaloids, which, containing pyroxenes and horn-blende-grünsteins, form strata in a transition-slate. The better to convey an idea of the whole situation and superposition of these rocks, we will name the formations as they occur in a profile drawn from north to south.

We find at first, in the Sierra de Mariara, which belongs to the northern branch of the Cordillera of the coast, a coarse-grained granite; then, in the valleys of Aragua, on the borders of the lake, and in the islands, it contains, as in the southern branch of the chain of the coast, gneiss and mica-slate. These last-named rocks are auriferous in the Quebrada del Oro, near Guigue; and between Villa de Cura and the Morros de San Juan, in the mountain of Chacao. The gold is contained in pyrites, which are found sometimes disseminated almost imperceptibly in the whole mass of the gneiss,* and sometimes united in small veins of quartz. Most of the torrents that traverse the mountains bear along with them grains of gold. The poor inhabitants of Villa de Cura and San Juan have sometimes gained thirty piastres a-day by washing the sand; but most

* The four metals, which are found disseminated in the granite rocks, as if they were of contemporaneous formation, are gold, tin, titanium, and cobalt.
commonly, in spite of their industry, they do not in a week find particles of gold of the value of two piastres. Here, however, as in every place where native gold and auriferous pyrites are disseminated in the rock, or by the destruction of the rocks, are deposited in alluvial lands, the people conceive the most exaggerated ideas of the metallic riches of the soil. But the success of the workings, which depends less on the abundance of the ore in a vast space of land than on its accumulation in one point, has not justified these favourable prepossessions. The mountain of Chacao, bordered by the ravine of Tucutunemo, rises seven hundred feet above the village of San Juan. It is formed of gneiss, which, especially in the superior strata, passes into micaslate. We saw the remains of an ancient mine, known by the name of Real de Santa Barbara. The works were directed to a stratum of cellular quartz,* full of polyhedric cavities, mixed with iron-ore, containing auriferous pyrites and small grains of gold, sometimes, it is said, visible to the naked eye. It appears that the gneiss of the Cerro do Chacao also furnishes another metallic deposit, a mixture of copper and silver-ores. This deposit has been the object of works attempted with great ignorance by some Mexican miners under the superintendance of M. Avalo. The gallery $\dagger$ directed to the north-east, is only twenty-five toises long. We there found some fine specimens of blue carbonated copper mingled with sulphate of barytes and quartz; but we could not ourselves judge whether the ore contained any argentiferous fahlerz, and whether it occurred in a stratum, or, as the apothecary who was our guide asserted, in real veiss. This much is certain, that the attempt at working the mine cost more than twelve thousand piastres in two years. It would no doubt have been more prudent to have resumed the works on the auriferous stratum of the Real de Santa Barbara.
* This stratum of quartz, and the gneiss in which it is contained, lie bor. 8 of the Freyberg compans, and dip $70^{\circ}$ to the south-west. At a hundred toises distance from the auriferous quartz, the gneiss resumes its ordinary situation, hor. 3-4, with $60^{\circ}$ dip to the north-west. A few strata of gneiss abound in silvery mica, and contain, instead of garnets, an immense quantity of small octohedrons of pyrites. This silvery gneiss resenables that of the famous mine of Himmelsfurst, in Saxony. † La Cueva de los Mexicanos.

The zone of gneiss just mentionsd is, in the coast-chain from the sea to the Filla de Cura, ten leagues broad. In this great extent of land, gneiss and mica-slate are found exclusively, and they constitute one formation.* Beyond the town of Villa de Cura and the Cerro de Chacao the aspect of the country presents greater geognostic variety. There are still eight leagues of declivity from the table-land of Cura to the entry of the Llanos; and on the southern slope of the mountains of the coast, four different formations of rock corer the gneiss. We shall first give the description of the different strata, without grouping them systematically.

On the south of the Cerro de Chacao, between the ravine of Tucutunemo and Piedras Negras, the gneiss is concealed beneath a formation of serpentine, of which the composition varies in the different superimposed strata. Sometimes it is very pure, very homogeneous, of a dusky olive-green, and of a conchoidal fracture: sometimes it is veined, mixed with bluish steatite; of an unequal fracture, and containing spangles of mica. In both these states I could not discover in it either garnets, hornblende, or diallage. Advancing farther to the south (and we always passed over this ground in that direction) the green of the serpentine grows deeper, and feldspar and hornblende are recognised in it: it is difficult to determine whether it passes into diabasis or alternates with it. There is, however, no doubt of its con-

* This formation, which we shall call gneiss-mica-slate, is peculiar to the chain of the coast of Caracas. Five formations must be distinguished, as MM. von Buch and Raumer have so ably demonstrated in their excellent papers on Landeck and the Riesengebirge, namely, granite, granite-gneiss, gneiss, gneiss-mica-slate, and mica-slate. Geologists whose researches have been confined to a small tract of land, having confounded these formations which nature has separated in several countries in the most distinct manner, have admitted that the gneiss and mica-slate alternate everywhere in superimposed beds, or furnish insensible transitions from one rock to the other. These transitions and alternating superpositions take place no doubt in formations of granitegneiss and gneiss-mica-slate; but because these phenomena are observed in one region, it does not follow that in other regions we may not find very distinct circumscribed formations of granite, gneiss, and mica-slate. The same considerations may be applied to the formations of serpentine, which are sometimes isolated, and sometimes belong to the eurite, micaslate, and grinstein.
taining veins of copper-ore.* At the foot of this mountain two fine springs gush out from the serpentine. Near the village of San Juan, the granular diabasis appears alone uncovered, and takes a greenish black hue. The feldspar intimately mixed with the mass, may be separated into distinct crystals. The mica is very rare, and there is no quartz. The mass assumes at the surface a yellowish crust like dolerite and basalt.

In the midst of this tract of trap-formation, the Morros of San Juan rise like two castles in ruins. They appear linked to the mornes of St Sebastian, and to La Galera which bounds the Llanos like a rocky wall. The Morros of San Juan are formed of limestone of a crystalline texture; sometimes very compact, sometimes spongy, of a greenishgrey, shining, composed of small grains, and mixed with scattered spangles of mica. This limestone yields a strong effervescence with acids. I could not find in it any vestige of organized bodies. It contains in subordinate strata, masses of hardened clay of a blackish blue, and carburetted. These masses are fissile, very heary, and loaded with iron; their streak is whitish, and they produce no effervescence with acids. They assume at their surface, by their decomposition in the air, a yellow colour. We seem to recognize in these argillaceous strata a tendency either to the transition-slates, or to the kieselschiefer (schistose jasper), which everywhere characterise the black transitionlimestones. When in fragments, they might be taken at first sight for basalt or hornblende. $\dagger$ Another white limestone, compact, and containing some fragments of shells, backs the Morros de San Juan. I could not see the line of junction of these two limestones, or that of the calcareous formation and the diabasis.

[^207]The tramsverse valley which descends from Piedras Negras and the village of San Juan, towards Parapara and the Llanos, is filled with trap-rocks, displaying close affinity with the formation of green slates, which they cover. Sometimes we seem to see serpentine, sometimes gränstein, and sometimes dolerite and basalt. The arrangement of these problematical masses is not. less extraordinary. Between San Juan, Malpaso, and Piedras Azules, they form strata parallel to each other; and dipping regularly northward at an angle of $40^{\circ}$ or $50^{\circ}$, they cover even the green slates in concordant stratification. Lower down, towards Parapara and Ortiz, where the amygdaloids and phonolites are connected with the grünstein, everything assumes a basaltic aspect. Balls of grünstein heaped one upon another, form those rounded cones, which are found so frequently in the Mittelgebirge in Bohemia, near Bilin, the country of phonolites. The following is the result of my partial observations.

The grünstein, which at first alternated with strata of serpentine, or was connected with that rock by insensible transitions, is seen alone, sometimes in strata considerably inclined, and sometimes in balls with concentric strata, imbedded in strata of the same substance. It lies, near Malpaso, on green slates, steatitic, mingled with hornblende, destitute of mica and grains of quartz, dipping, like the grünsteins, $45^{\circ}$ toward the north, and directed, like them, $75^{\circ}$ north-west.

A great sterility prevails where these green slates predominate, no doubt on account of the magnesia they contain, which (as is proved by the magnesian-limeatone of England*) is very hurtful to vegetation. The dip of the green slates continues the same; but by degrees the direction of their strata becomes parallel to the general direction of the primitive rocks of the chain of the coast. At Piedras Azules these slates, mingled with hornblende, cover in concordant stratification a blackish-blue slate, very fissile, and traversed by small veins of quartz. The green slates include some strata of grünstein, and even contain balls of that substance. I nowhere saw the green slates alternate with

* Magnesian limestone is of a straw-yellow colour, and contains madrepores : it lies beneath red marl, or muriatiferous red sandstone.
the black slates of the ravine of Piedras Azules: at the line of junction these two slates appear rather to pass one into the other, the green slates becoming of a pearl-grey in proportion as they lose their hornblende.

Farther south, towards Parapara and Ortiz, the slates disappear. They are concealed under a trap-formation more varied in its aspect. The soil becomes more fertile; the rocky masses alternate with strata of clay, which appear to be produced by the decomposition of the grünstems, the amygdaloids, and the phonolites.

The grünstein, which farther north was less granulous, and passed into serpentine, here assumes a very different character. It contains balls of mandelstein, or amygdaloid, eight or ten inches in diameter. These balls, sometimes a little flattened, are divided into concentric layers: this is the effect of decomposition. Their nucleus is almost as hard as basalt, and they are intermingled with little cavities, owing to bubbles of gas, filled with green earth, and crystals of pyroxene and mesotype. Their basis is greyish blue, rather soft, and showing small white spots which, by the regular form they present, I should conceive to be decomposed feldspar. M. von Buch examined with a powerful lens the species we brought. He discovered that each crystal of pyroxene, enveloped in the earthy mass, is separated from it by fissures parallel to the sides of the crystal. These fissures seem to be the effect of a contraction which the mass or basis of the mandelstein has undergone. I sometimes saw these balls of mandelstein arranged in strata, and separated from each other by beds of grünstein of ten or fourteen inches thick; sometimes (and this situation is most common) the balls of mandelstein, two or three feet in diameter, are found in heaps, and form little mounts with rounded summits, like spheroidal basalt. The clay which separates these amygdaloid concretions arises from the decomposition of their crust. They acquire by the contact of the air a very thin coating of yellow ochre.

South-west of the village of Parapara rises the little Cerro de Flores, which is discerned from afar in the steppes. Almost at its foot, and in the midst of the mandelstein tract we have just been describing, a porphyritic phonolite, a mass of compact feldspar of a greenish grey, or mountain-
green, containing long crystals of vitreous feldspar, appears exposed. It is the real porphyrschiefer of Werner; and it would be difficult to distinguish, in a collection of stones, the phonolite of Parapara from that of Bilin, in Bohemia. It does not, however, here form rocks in grotesque shapes;' but little hills covered with tabular blocks, large plates extremely sonorous, translucid on the edges, and wounding the hands when broken.

Such are the successions of rocks, which I described on the spot as I progressively found them, from the lake of Tacarigua to the entrance of the steppes. Few places in Europe display a geological arrangement so well worthy of being studied. We saw there in succession six formations: viz., mica-slate-gneiss, green transition-slate, black transi-: tion-limestone, serpentine and grünstein, amygdaloid (with pyroxene), and phonolite.

I must observe, in the first place, that the substance just described under the name of grünstein, in every respect resembles that which forms layers in the mica-slate of Cabo Blanco, and veins near Caracas. It differs only by containing neither quartz, garnets, nor pyrites. The close relations we observed near the Cerro de Chacao, between the grünstein and the serpentine, cannot surprise these geologists who have studied the mountains of Franconia and Silesia. Near Zobtenberg* a serpentine rock alternates also with gabbro. In the district of Glatz the fissures of the gabbro are filled with a steatite of a greenish white colour, and the rock which was long thought to belong to the grünsteins $\dagger$ is a close mixture of feldspar and diallage.

[^208]The grünsteins of Tucutunemo, which we consider as constituting the same formation as the serpentine rock, contain veins of malachite and copper-pyrites. These same metalliferous combinations are found also in Franconia, in the grünsteins of the mountains of Steben and Lichtenberg. With respect to the green slates of Malpaso, which have all the characters of transition-slates, they are identical with those which M. von Buch has so well described, near Schönau, in Silesia. They contain beds of grünstein, like the slates of the mountains of Steben just mentioned.* The black limestone of the Morros de San Juan is also a transition-limestone. It forms perhaps a subordinate stratum in the slates of Malpaso. This situation would be analogous to what is observed in several parts of Switzerland. + The slaty zone, the centre of which is the ravine of Piedras Azules, appears divided into two formations. On some points we think we observe one passing into the other.

The grünsteins, which begin again to the south of these slates, appear to me to differ little from those found north of the ravine of Piedras Azules. I did not see there any pyroxene; but on the very spot I recognized a number of crystals in the amygdaloid, which appears so strongly linked to the grünstein that they alternate several times.

The geologist may consider his task as fulfilled when he has traced with accuracy the positions of the diverse strata; and has pointed out the analogies traceable between these positions and what has been observed in other countries. But how can he avoid being tempted to go back to the origin of so many different substances, and to inquire how far the dominion of fire has extended in the mountains that bound the great basin of the steppes? In researches on the position of rocks we have generally to complain of not sufficiently perceiving the connection between the masses, which we believe to be superimposed on one another. Here the

[^209]difficulty seems to arise from the too intimate and too numerous relations observed in rocks that are thought not to belong to the same family.

The phonolite (or leucostine compacte of Cordier) is pretty generally regarded by all who have at onee examined burning and extinguished volcanos, as a flow of lithoid lava I found no real basalt or dolerite; but the presence of pyroxene in the amygdaloid of Parapara leaves little doubt of the igneous origin of those spheroidal masses, fissured, and full of cavities. Balls of this amygdaloid are enclosed in the grünstein; and this grünstein alternates on one side with a green slate, on the other with the serpentine of Tucutunemo. Here, then, is a connexion sufficiently close established between the phonolites and the green slates, between the pyroxenic amygdaloids and the serpentines containing copper-ores, between volcanic substances and others that are included under the vague name of transition-traps. All these masses are destitute of quartz like the real trap-porphyries, or volcanic trachytes. This phenomenon is the more remarkable, as the grünsteins which are called primitive almost always contain quartz in Europe. The most general dip of the slates of Piedras Azules, of the grünsteins of Parapara, and of the pyrorenic amygdaloids embedded in strata of grünstein, does not follow the slope of the ground from north to south, but is pretty regular towards the north. The strata incline towards the chain of the coast, as substances which had not been in fusion might be supposed to do. Can we admit that so many alternating rocks, imbedded one in the other, have a common origin? The nature of the phonolites, which are lithoid lavas with a feldspar basis, and the nature of the green slates intermixed with hornblende, oppose this opinion. In this state of things we may choose between two solutions of the problem in question. In one of these solutions the phonolite of the Cerro de Flores is to be regarded as the sole volcanic production of the tract; and we are forced to unite the pyroxenic amygdaloids with the rest of the grünsteins, in one single formation, that which is so common in the, transition-mountains of Europe, considered hitherto as not volcanic. In the other solution of the problem, the masses of phonolite, amygdaloid, and grünstein, which are found
in the south of the ravine of Piedras Azules, are separated from the grünsteins and serpentine rocks that cover the declivity of the mountains north of the ravine. In the present state of knowledge I find difficulties almost equally great in adopting either of these suppositions; but I have no doubt that, when the real gränsteins (not the hornblendegrünsteins) contained in the gueiss and mica-slates, shall have been more attentively examined in other places; when the basalts (with pyroxene) forming strata in primitive rocks* and the diabases and amygdaloids in the transition mountains, shall have been carefully studied; when the texture of the masses shall have been subjected to a kind of mechanical analysis, and the hornblendes better distinguished from the pyroxenes, $\dagger$ and the grünsteins from the dolerites; a great number of phenomena which now appear isolated and obscure, will be ranged under general laws. The phonolite and other rocks of igneous origin at Parapara are so much the more interesting, as they indicate ancient eruptions in a granite zone; as they belong to the shore of the basin of the steppes, as the basalts of Harrutsh belong to the shore of the desert of Sahara; and lastly, as they are the only rocks of the kind we observed in the mountains of the Capitania-General of Caracas; which are also destitute of trachytes or trap-porphyry, basalts, and volcanic productions. $\ddagger$

The southern declivity of the western chain is tolerably steep; the steppes, according to my barometrical measurements, being a thousand feet lower than the bottom of the basin of Aragua. From the extensive table-land of the Villa de Cura we descended towards the banks of the Rio Tucutunemo, which has hollowed for itself, in a serpentine rock, a longitudinal valley running from east to west, at nearly the same level as La Victoria. A transverse valley, lying generally north and south, led us into the Llanos, by

[^210]the villages of Parapara and Ortiz. It grows very narrow in several parts. Basins, the bottoms of which are perfectly horizontal, communicate together by narrow passes with steep declivities. They were, no doubt, formerly small lakes, which, owing to the accumulation of the waters, or some more violent catastrophe, have broken down the dykes by which they were separated. This phenomenon is found in both continents, wherever we examine the longitudinal valleys forming the passages of the Andes, the Alps,*' or the Pyrenees. It is probable, that the irruption of the waters towards the Llanos have given, by extraordinary rents, the form of ruins to the Morros of San Juan and of San Sebastian. The volcanic tract of Parapara and Ortis is now only 30 or 40 toises above the Llanos. The eruptions consequently took place at the lowest point of the granitic chain.
In the Mesa de Paja, in the ninth degree of latitude, we entered the basin of the Llanos. The sun was almost at its zenith; the earth, wherever it appeared sterile and destitute of vegetation, was at the temperature of $48^{\circ}$ or $50^{\circ} . \dagger$ Not a breath of air was felt at the height at which we were on our mules; yet, in the midst of this apparent calm, whirls of dust incessantly arose, driven on by those small currents of air which glide only over the surface of the ground, and are occasioned by the difference of temperature between the naked sand and the spots covered with grass. These sand-winds augment the suffocating heat of the air. Every grain of quartz, hotter than the surrounding air, radiates heat in every direction; and it is difficult to observe the temperature of the atmosphere, owing to these particles of sand striking against the bulb of the thermometer. All around us the plains seemed to ascend to the sky, and the vast and profound solitude appeared like an ocean covered with sea-weed. According to the unequal mass of vapours diffused through the atmosphere, and the variable decrement in the temperature of the different strata of air, the horizon in some parts was clear and distinct; in other parts it appeared undulating, sinuous, and as if striped.

[^211]The earth there was confounded with the sky. Through the dry mist and strata of vapour the trunks of palm-trees were seen from afar, stripped of their foliage and their verdant summits, and looking like the masts of a ship descried upon the horizon.
There is something awful, as well as sad and gloomy, in the uniform aspect of these steppes. Everything seems motionless; scarcely does a small cloud, passing across the zenith, and denoting the approach of the rainy season, cast its shadow on the earth. I know not whether the first aspect of the Llanos excite less astonishment than that of the chain of the Andes. Mountainous countries, whatever may be the absolute elevation of the highest summits, have an anologous physiognomy; but we accustom ourselves with difficulty to the view of the Llanos of Venezuela and Casanare, to that of the Pampas of Buenos Ayres and of Chaco, which recal to mind incessantly, and during journeys of twenty or thirty days, the smooth surface of the ocean. I had seen the plains or llanos of La Mancha in Spain, and the heaths (ericeta) that extend from the extremity of Jutland, through Luneburg and Westphalia, to Belgium. These last are really steppes, and, during several ages, only small portions of them have yielded to cultivation; but the plains of the west and north of Europe present only a feeble image of the immense llanos of South America. It is in the southeast of our continent, in Hungary, between the Danube and the Theiss; in Russia, between the Borysthenes, the Don, and the Volga, that we find those vast pastures, which seem to have been levelled by a long abode of the waters, and which meet the horizon on every side. The plains of Hungary, where I traversed them on the frontiers of Germany, between Presburg and Edenburg, strike the imagination of the traveller by the constant mirage; but their greatest extent is more to the east, between Czegled, Debreczin, and Tittel. There they present the appearance of a vast ocean of verdure, having only two outlets, one near Gran and Waitzen, the other between Belgrade and Widdin.
The different quarters of the world have been supposed to be characterized by the remark, that Europe has its heaths, Asia its steppes, Africa its deserts, and America its savannahs; but by this distinction, contrasts are established that
are not founded either on the nature of things, or the genius of languages. The existence of a heath always supposes an association of plants of the family of erica; the steppes of Asia are not everywhere covered with saline plants; the savannahs of Venezuela furnish not only the gramina, but with them small herbaceous mimosas, legumina, and other dicotyledonous plants. The plains of Songaria, those which extend between the Don and the Volga, and the puszta of Hungary, are real savannahs, pasturages abounding in grasses;* while the savannahs to the east and west of the Rocky Mountains and of New Mexico produce chenopodiums containing carbonate and mariate of soda. Asia has real deserts destitute of vegetation, in Arabia, in Gobi, and in Persia. Since we have become better acquainted with the deserts in the interior of Africa, so long and so vaguely confounded together under the name of desert of Sahara (Zahra); it has been observed, that in this continent, towards the east, savannahs and pastures are found, as in Arabia, situated in the midst of naked and barren tracts. It is these deserts, covered with gravel and destitute of plants, which are almost entirely wanting in the New World. I saw them only in that part of Peru, between Amotape and Coquimbo, on the shores of the Pacific. These are called by the Spaniards, not llanos,

[^212]but the desiertos of Sechura and Atacamez. This solitary tract is not broad, but it is four hundred and forty leagues long. The rock pierces everywhere though the quicksands. No drop of rain ever falls on it; and, like the desert of Sahara, north of Timbuctoo, the Peruvian desert affords, near Huaura, a rieh mine of native salt. Everywhere else, in the New World, there are plains desert because not inhabited, but no real deserts.*

The same phenomena are repeated in the most distant regions; and, instead of designating those vast treeless plains in accordance with the nature of the plants they produce, it seems natural to class them into deserts, steppes, or savannahs; into bare lands without any appearance of vegetation, and lands covered with gramina or small plants of the dicotyledonous tribe. The savannahs of America, especially those of the temperate zone, have in many works been designated by the Franch term prairies; but this appears to me little applicable to pastures which are often very dry, though covered with grass of four or five feet in height. The Llanos and the Pampss of South America are really steppes. They are covered with beautiful verdure in the rainy season, but in the time of great drought they assume the aspect of a desert. The grass is then reduced to powder; the earth cracks; the alligators and the great sorpents remain buried in the dried mud, till awakened from their long lethargy by the first showers of spring. These phenomena are observed on barren tracts of fifty or sixty leagues in length, wherever the savannahs are not traversed by rivers; for on the borders of rivulets, and around little pools of stagnant water, the traveller finds at certain distances, even during the period of the great droughts, thickets of mauritia, a palm, the leaves of which spread out like a fan, and preserve a brilliant verdure.

The steppes of Asia are all beyond the tropics, and form very elevated table-lands. America also has savannahs of

[^213]considerable extent on the backs of the mountains of Mexico, Peru, and Quito; but its most extensive steppes, the Llanos of Cumana, Caracas, and Meta, are little raised above the level of the ocean, and all belong to the equinoctial zone. These circumstances give them a peculiar character. They have not, like the steppes of southern Asia, and the deserts of Persia, those lakes without issue, those small systems of rivers which lose themselves either in the sands, or by subterranean filtrations. The Llanos of America incline to the east and south; and their running waters are branches of the Orinoco.

The course of these rivers once led me to believe, that the plains formed table-lands, raised at least from one hundred to one hundred and fifty toises above the level of the ocean. I supposed that the deserts of interior Africa were also at a considerable height; and that they rose one above another as in tiers, from the coast to the interior of the continent. No barometer has yet been carried into the Sahara. With respect to the Llanos of America, I found by barometric heights observed at Calabozo, at the Villa del Pao, and at the mouth of the Meta, that their height is only forty or fifty toises above the level of the sea. The fall of the rivers is extremely gentle, often nearly imperceptible; and therefore the least wind, or the swelling of the Orinoco, causes a reflux in those rivers that flow into it. The Indians believe themselves to be descending during a whole day, when navigating from the mouths of these rivers to their sources. The descending waters are separated from those that flow back by a great body of stagnant water, in which, the equilibrium being disturbed, whirlpools are formed very dangerous for boats.

The chief characteristic of the savannahs or steppes of South America is the absolute want of hills and inequalities, -the perfect level of every part of the soil. Accordingly the Spanish conquerors, who first penetrated from Coro to the banks of the Apure, did not call them deserts or savannahs, or meadows, but plains (llanos). Often within a distance of thirty square leagues there is not an eminence of a foot high. This resemblance to the surface of the sea strikes the imagination most powerfully where the plains are
altogether destitute of palm-trees; and where the mountains of the shore and of the Orinoco are so distant that they cannot be seen, as in the Mesa de Pavones. A person would be tempted there to take the altitude of the sun with a quadrant, if the horizon of the land were not constantly misty on account of the variable effects of refraction. This equality of surface is still more perfect in the meridian of Calabozo, than towards the east, between Cari, La Villa del Pao, and Nueva Barcelona; but it extends without interruption from the mouths of the Orinoco to La Villa de Araure and to Ospiños, on a parallel of a hundred and eighty leagues in length; and from San Carlos to the savannahs of Caqueat, on a meridian of two hundred leagues. It particularly characterises the New Continent, as it does the low steppes of Asia, between the Borysthenes and the Volga, between the Irtish and the Obi. The deserts of central Africa, of Arabia, Syria, and Persia, Gobi, and Casna, present, on the contrary, many inequalities, ranges of hills, ravines without water, and rocks which pierce the sands.

The Llanos, however, notwithstanding the apparent uniformity of their surface, present two kinds of inequalities, which cannot escape the observation of the traveller. The first is known by the name of banks (bancos); they are in reality 8 hoals in the basin of the steppes, fractured strata of sandstone, or compact limestone, standing four or five feet higher than the rest of the plain. These banks are sometimes three or four leagues in length; they are entirely smooth, with a horizontal surface; their existence is perceived only by examining their margins. The second species of inequality can be recognised only by geodesical or barometric levellings, or by the course of rivers. It is called a mesa or table, and is composed of small flats, or rather convex eminences, that rise insensibly to the height of a few toises. Such are, towards the east, in the province of Cumana, on the north of the Villa de la Merced and Candelaria, the Mesas of Amana, of Guanipa, and of Jonoro, the direction of which is south-west and north-east; and which, in spite of their inconsiderable elevation, divide the waters between the Orinoco and the northern coast of Terra Firma. The convexity of the savannah alone occasions this partition: we there find the 'dividing of the waters' (divortia aqua-
rum*), as in Poland, where, far from the Carpathian mountains, the plain itself divides the waters between the Baltic and the Black Sea. Geographers, who suppose the existence of a chain of mountains wherever there is a line of division, have not failed to mark one in the maps, at the sources of the Rio Neveri, the Unare, the Guarapiche, and the Pao. Thus the priests of Mongol race, according to ancient and superstitious custom, erect oboes, or little mounds of stone, on every point where the rivers flow in an opposite direction.

The uniform landscape of the Llanos; the extremely small number of their inhabitants; the fatigue of travelling beneath a burning sky, and an atmosphere darkened by dust; the view of that horizon, which seems for ever to fly before us; those lonely trunks of palm-trees, which have all the same aspect, and which we despair of reaching, because they are confounded with other trunks that rise by degrees on the visual horizon; all these causes combine to make the steppes appear far more extensive than they are in reality. The planters who inhabit the southern declivity of the chain of the coast see the steppes extend towards the south, as far as the eye can reach, like an ocean of verdure. They know that from the Delta of the Orinoco to the province of Varinas, and thence, by traversing the banks of the Meta, the Guaviare, and the Caguan, they can advance three hundred and eighty leagues $\dagger$ into the plains, first from east to west, and then from north-east to south-east beyond the Equator, to the foot of the Andes of Pasto. They know by the accounts of travellers the Pampas of Buenos Ayres, which are also Llanos covered with fine grass, destitute of trees, and filled with oxen and horses become wild. They suppose that, according to the greater part of our maps of America, this continent has only one chain of mountains, that of the Andes, which stretches from south to north; and they form a vague idea of the contiguity of all the plains from the Orinoco and the Apure to the Rio de la Plata and the Straits of Magellan.

Without stopping here to give a mineralogical description

[^214]of the transverse chains which divide America from east to west, it will be sufficient to notice the general structure of a continent, the extremities of which, though situated in climates little analogous, nevertheless present several features of resemblance. In order to have an exactidea of the plains, their configuration, and their limits, we must know the chains of mountains that form their boundaries. We have already described the Cordillera of the coast, of which the highest summit is the Silla de Caraccas, and which is linked by the Paramo de las Rosas to the Nevada de Merida, and the Andes of New Grenada. We have seen that, in the tenth degree of north latitude, it stretches from Quibor and Barquesimeto as far as the point of Paria. A second chain of mountains, or rather a less elevated but much larger group, extends between the parallels of $3^{\circ}$ and $7^{\circ}$ from the mouths of the Guaviare and the Meta to the sources of the Orinoco, the Marony, and the Essequibo, towards French and Dutch Guiana: I call this chain the Cordillera of Parime, or of the great cataracts of the Orinoco. It may be followed for a length of two hundred and fifty leagues; but it is less a chain, than a collection of granitic mountains, separated by small plains, without being everywhere disposed in lines. The group of the mountains of Parime narrows considerably between the sources of the Orinoco and the mountains of Demerara, in the Sierras of Quimiropaca and Pacaraimo, which divide the waters between the Carony and the Rio Parime, or Rio de Aguas Blancas. This is the scene of the expeditions which were undertaken in search of El Dorado, and the great city of Manoa, the Timbuctoo of the New Continent. The Cordillera of Parime does not join the Andes of New Grenada, but is separated from them by a space eighty leagues broad. If we suppose it to have been destroyed in this space by some great revolution of the globe (which is scarcely probable) we must admit that it anciently branched off from the Andes between Santa Fé de Bogotá and Pamplona. This remark serves to fix more easily in the memory of the reader the geographical position of a Cordillera till now very imperfectly known. A third chain of mountains unites in $16^{\circ}$ and $18^{\circ}$ south latitude (by Santa Cruz de la Sierra, the Serranias of Aguapehy, and the famous

Campos dos Parecis) the Andes of Peru, to the mountains of Brazil. It is the Cordillera of Chiquitos which widens in the Capitania de Minas Geräes, and divides the rivers flowing into the Amazon from those of the Rio de la Plata,* not only in the interior of the country, in the meridian of Villa Boa, but also at a few leagues from the coast, between Rio Janeiro and Bahia. $\dagger$

These three transverse chains, or rather these three groups of mountains stretching from west to east, within the limits of the torrid zone, are separated by tracts entirely level, the plains of Caracas, or of the Lower Orinoco; the plains of the Amazon and the Rio Negro; and the plains of Buenos Ayres, or of La Plata. I use the term plains, because the Lower Orinoco and the Amazon, far from flowing in a valley, form but a little furrow in the midst of a vast level. The two basins, placed at the extremities of South America, are savannahs or steppes, pasturage without trees; the intermediate basin, which receives the equatorial rains during the whole year, is almost entirely one vast forest, through which no other roads are known save the rivers. The strong vegetation which conceals the soil, renders also the uniformity of its level less perceptible; and the plains of Caracas and La Plata bear no other name. The three basins we have just described are called, in the language of the colonists, the Llanos of Varinas and of Caracas, the bosques or selvas (forests) of the Amazon, and the Pampas of Buenos Ayres. The trees not only for the most part cover the plains of the Amazon, from the Cordillera de Chiquitos, as far as that of Parime; they also crown these two chains of mountains, which rarely attain the height of the Pyrenees. $\ddagger$ On this account, the vast plains of the Amazon, the Madeira, and the Rio Negro, are not so distinctly bounded as the Llanos of Caracas, and the

* There is only a portage or carrying-place of 5,322 braças between the Guapore (a branch of the Marmore and of the Madeira), and the Rio Aguapehy (a branch of the Jaura and of the Paraguay).
$\dagger$ The Cordillera of Chiquitos and of Brazil stretches toward the southeast, in the government of the Rio Grande, beyond the latitude of $30^{\circ}$ south.
$\ddagger$ We must except the most western part of the Cordillera of Chiquitos, between Cochabamba and Santa Cruz de la.Sierra, where the summits

Pampas of Buenos Ayres. As the region of forests comprises at once the plains and the mountains, it extends from $18^{\circ}$ south to $7^{\circ}$ and $8^{\circ}$ north,* and occupies an extent of near a hundred and twenty thousand square leagues. This forest of South America, for in fact there is only one, is six times larger than France. It is known to Europeans only on the shores of a few rivers, by which it is traversed; and has its openings, the extent of which is in proportion to that of the forests. We shall soon skirt the marshy savannahs, between the Upper Orinoco, the Conorichite, and the Cassiquiare, in the latitude of $3^{\circ}$ and $4^{\circ}$. There are other openings, or as they are called, 'clear savannahs,' $\dagger$ in the same parallel, between the sources of the Mao and the Rio de Aguas Blancas, south of the Sierra de Pacaraima. These last savannahs, which are inhabited by Caribs, and nomad Macusis, lie near the frontiers of Dutch and French Guiana.
Having noticed the geological constitution of South America, we shall now mark its principal features. The western coasts are bordered by an enormous wall of mountains, rich in precious metals wherever volcanic fire has not pierced through the eternal snow. This is the Cordillera of the Andes: Summits of trap-porphyry rise beyond three thousand three hundred toises, and the mean height of the chain $\ddagger$ is one thousand eight hundred and fifty toises. It stretches in the direction of a meridian, and sends into each hemisphere a lateral branch, in the latitudes of $10^{\circ}$ north, and $16^{\circ}$ and $18^{\circ}$ south. The first of these two branches, that of the coast of Caracas, is of considerable length, and forms in fact a chain. The second branch, the Cordillera of

[^215]Chiquitos and of the sources of the Guapore, is very rich in gold, and widens toward the east, in Brazil, into vast tablelands, having a mild and temperate climate. Between these two transverse chains, contiguous to the Andes, an isolated group of granitic mountains is situated, from $3^{\circ}$ to $7^{\circ}$ north latitude; which also runs parallel to the Equator, but, not passing the meridian of $71^{\circ}$, terminates abruptly towards the west, and is not united to the Andes of New Grenada. These three transverse chains have no active volcanos; we know not whether the most southern, like the two others, be destitute of trachytes or trap-porphyry. None of their summits enter the limit of perpetaal snow; and the mean height of the Cordillera of La Parime, and of the littoral chain of Caraeas, does not reach six hundred toises, though some of its summits rise fourteen hundred toises above the level of the sea.* The three transverse chains are separated by plains entirely closed towards the west, and open towards the east and south-east. When we reflect on their small elevation above the suxface of the ocean, we are tempted to consider them as gulfs stretching in the direction of the current of rotation. If, from the effect of some peculiar attraction, the waters of the Atlantic were to rise fifty toises at the month of the Orinoco, and two hundred toises at the mouth of the Amazon, the flood would submerge more than the half of South America. The eastern declivity, or the foot of the Andes, now six hundred leagues distant from the - coast of Brazil, would become a shore beaten by the waves. This consideration is the result of a barometric measurement, taken in the province of Jaen de Bracamoros, where the river Amazon issues from the Cordilleras. I found the mean height of this immense river only one hundred and ninetyfour toises above the present level of the Atlantic. The intermediate plains, however, covered with forests, are still five times higher than the Pampas of Buenos Ayres, and the grass-covered Llanos of Caracas and the Meta.

Those Llanos which form the basin of the Orinoco, and which we crossed twice in one year, in the months of March

[^216]and July, communicate with the basin of the Amazon and the Rio Negro, bounded on one side by the Cordillera of Chiquitos, and on the other by the mountains of Parime. The opening which is left between the latter and the Andes of New Grenada, occasions this communication. The aspect of the country here reminds us, but on a much larger scale, of the plains of Lombardy, which also are only fifty or sixty toises above the level of the ocean; and are directed first from La Brenta to Turin, east and west ; and then from Turin to Coni, north and south. If we were authorized, from other geological facts, to regard the three great plains of the Lower Orinoco, the Amazon, and the Rio de la Plata as basins of ancient lakes,* we should imagine we perceived in the plains of the Rio Vichada and the Meta, a channel by which the waters of the upper lake (those of the plains of the Amazon) forced their way towards the lower basin, (that of the Llanos of Caracas,) separating the Cordillera of La Parime from that of the Andes. This channel is a kind of land-strait. The ground, which is perfectly level between the Guaviare, the Meta, and the Apure, displays no vestige of a violent irruption of the waters; but on the edge of the Cordillera of Parime, between the latitudes of $4^{\circ}$ and $7^{\circ}$, the Orinoco, flowing in a westerly direction from its source to the mouth of the Guariare, has forced its way through the rocks, directing its course from south to north. All the great cataracts, as we shall soon see, are within the latitudes just named. When the river has reached the mouth of the Apure in that very low ground where the slope towards the north is met by the counter-slope towards the south-east, that is to say, by the inclination of the plains which rise imperceptibly towards the mountains of Caracas, the river turns anew and flows eastward. It appeared to me, that it was proper to fix the attention of the reader on these singular inflexions of the Orinoco because, belonging at once to two basins, its course marks, in some sort, even on the most imperfect maps, the direction of that part of the plains intervening

[^217]between New Grenada and the western border of the mountains of La Parime.

The Llanos or steppes of the Lower Orinoco and of the Meta, like the deserts of Africa, bear different names in different parts. From the mouths of the Dragon the Llanos of Cumana, of Barcelona, and of Caracas or Venezuela,* follow, running from east to west. Where the steppes turn towards the south and south-south-west, from the latitude of $8^{\circ}$, between the meridians of $70^{\circ}$ and $73^{\circ}$, we find from north to south, the Llanos of Varinas, Casanare, the Meta, Guaviare, Caguau, and Caqueta. $\dagger$ The plains of Varinas contain some few monuments of the industry of a nation that has diappeared. Between Mijagual and the Caño de la Hacha, we find some real tumuli, called in the country the Serillos de los Indios. They are hillocks in the shape of cones, artificially formed of earth, and probably contain bones, like the tumuli in the steppes of Asia. A fine road is also discovered near Hato de la Calzada, between Varinas and Canagua, five leagues long, made before the conquest, in the most remote times, by the natives. It is a causeway of earth fifteen feet high, crossing a plain often overflowed. Did nations farther advanced in civilization descend from the mountains of Truxillo and Merido to the plains of the Rio Apure? The Indians whom we now find between this river and the Meta, are in too rude a state to think of making roads or raising tumuli.

I calculated the area of these Llanos from the Caqueta to the Apure, and from the Apure to the Delta of the Orinoco, and found to be it seventeen thousand square

* The following are subdivisions of these three great Llanos, as I marked them down on the spot. The Llanos of Cumana and New Andalusia include those of Maturin and Terecen, of Amana, Guanipa, Jonoro, and Cari. The Llanos of Nueva Barcelona comprise those of Aragua, Pariaguan, and Villa del Pao. We distinguish in the Llanos of Caracas those of Chaguaramas, Uritucu, Calabozo or Guarico, La Portuguesa, San Carlos, and Araure.
$\dagger$ The inhabitants of these plains distinguish as subdivisions, from the Rio Portuguesa to Caqueta, the Llanos of Guanare, Bocono, Nutrius or the Apure, Palmerito near Quintero, Guardalito and Arauca, the Meta, Apiay near the port of Packaquiaro, Vichada, Guaviare, Arriari, Inirida, the Rio Hacha, and Caguan. The limits between the savannahs and the forests, in the plains that extend from the sources of the Rio Negro to Putumayo, are not sufficiently known.
leagues twenty to a degree. The part running from north o south is almost double that which stretches from east to rest, between the Lower Orinoco and the littoral chain of Caracas. The Pampas on the north and north-west of 3uenos Ayres, between this city and Cordova, Jujuy, and she Tucuman, are of nearly the same extent as the Llanos; but the Pampas stretch still farther on to the length of $18^{\circ}$ southward; and the land they occupy is so vast, that they produce palm-trees at one of their extremities, while the other, equally low and level, is covered with eternal frost.
The Llanos of America, where they extend in the direction of a parallel of the equator, are three-fourths narrower than the great desert of Africa. This circumstance is very important in a region where the winds constantly blow from east to west. The farther the plains stretch in this direction, the more ardent is their climate. The great ocean of sand in Africa communicates by Yemen* with Gedrosia and Beloochistan, as far as the right bank of the Indus. It is from the effect of winds that have passed over the deserts situated to the east, that the little basin of the Red Sea, surrounded by plains which send forth from all sides radiant caloric, is one of the hottest regions of the globe. The unfortunate captain Tuckey relates, $\dagger$ that the centigrade thermometer keeps there generally in the night at $34^{\circ}$, and by day from $40^{\circ}$ to $44^{\circ}$. We shall soon see that, even in the westernmost part of the steppes of Caracas, we seldom found the temperature of the air, in the shade, above $37^{\circ}$.
* We cannot be surprised that the Arabic should be richer than any other language of the East in words expressing the ideas of desert, uninhabited plains, and plains covered with gramina. I could give a list of thirty-five of these words, which the Arabian authors employ without always distinguishing them by the shades of meaning which each separate word expresses. Makadh and kaâh indicate, in preference, plains; bakaâh, a table-land; kafr, mikfar, smlis, mahk, and habaucer, a naked desert, covered with sand and gravel ; tanufah, a steppe. Zahra means at once a naked desert and a savannah. The word steppe, or step, is Russian, and not Tartarian. In the Turco-Tartar dialect a heath is called tala or tschol. The word gobi, which Europeans have corrupted into cobi, signifies in the Mongol tongue a naked desert. It is equivalent to the scha-mo or khan-hai of the Chinese. A steppe, or plain covered with herbs, is in Mongol, kudah; in Chinese, kouang.
$\dagger$ Expedition to explore the river Zahir, 1818.
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These physical considerations on the steppes of the New World are linked with others more interesting, inasmuch as they are connected with the history of our speeies. The great sea of sand in Africa, the deserts without water, are frequented only by caravans, that take fifty days to traverse them.*. Separating the Negro race from the Moors, and the Berber and Kabyle tribes, the Sabara is inhabited only in the oases. It affords pasturage only in the eastern part, where, from the effect of the trade-winds, the layer of sand being less thick, the springs appear at the surface of the earth. In America, the steppes, less vast, less scorching, fertilized by fine rivers, present fewer obstacles to the intercourse of nations. The Llanos separate the chain of the coast of Caracas and the Andes of New Grenada from the region of forests; from that woody region of the Orinoco which, from the first discovery of America, has been inhabited by nations more rude, and farther removed from civilization, than the inhabitants of the coast, and still more than the mountaineers of the Cordilleras. The steppes, however, were no more heretofore the rampart of civilization than they are now the rampart of the liberty of the hordes that live in the forests. They have not hindered the nations of the Lower Orinoco from going up the little rivers and making incursions to the north and the west. If, according to the various distribution of animals on the globe, the pastoral life could have existed in the New World,-if, before the arrival of the Spaniards, the Llanos and the Pampas had been filled with those numerous herds of cows and horses that graze there, Columbus would have found the human race in a state quite different. Pastoral nations living on milk and cheese, real nomad races, would have spread themselves over those vast plains which communicate with each other. They would have been seen at the period of great droughts, and even at that of inundations, fighting for the possession of pastures; subjugating one another mutually; and, united by the common tie of manners, language, and worship, they would have risen to that state of demi-civilization which we observe with surprise in the nations of the Mongol and Tartar race.

* This is the maximum of the time, according to Major Rennell. (Travels of Mungo Park, vol. ii.)

America would then, like the centre of Asia, have had its conquerors, who, ascending from the plains to the tablelands of the Cordilleras, and abandoning a wandering life, would have subdued the civilized nations of Peru and New Grenada, overturned the throne of the Incas and of the Zaque,* and substituted for the despotism which is the fruit of theocracy, that despotism which arises from the patriarchal government of a pastoral people. In the New World the human race has not experienced these great moral and political changes, because the steppes, though more fertile than those of Asia, have remained without herds; because none of the animals that furnish milk in abundance are natives of the plains of South America; and because, in the progressive unfolding of American civilization, the intermediate link is wanting that connects the hunting with the agricultural nations.

We have thought proper to bring together these general notions on the plains of the New Continent, and the contrast they exhibit to the deserts of Africa and the fertile steppes of Asia, in order to give some interest to the narrative of a journey across lands of so monotonous an aspect. Having now accomplished this task, I shall trace the route by which we proceeded from the volcanic mountains of Parapara and the northern side of the Llanos, to the banks of the Apure, in the province of Varinas.

After having passed two nights on horseback, and sought in vain, by day, for some shelter from the heat of the sun beneath the tufts of the moriche palm-trees, we arrived before night at the little Hato del Cayman, $\dagger$ called also La Guadaloupe. It was a solitary house in the steppes, surrounded by a few small huts, covered with reeds and skins. The cattle, oxen, horses, and mules are not penned, but wander freely over an extent of several square leagues. There is nowhere any enclosure ; men, naked to the waist and armed with a lance, ride over the savannahs to inspect the animals; bringing back those that wander too far from the pastures of the farm, and branding all that do not already bear the mark of their proprietor. These mulattos, who are known

[^218]H 2
by the name of peones llaneros, are partly freed-men and partly slaves. They are constantly exposed to the burning heat of the tropical sun. Their food is meat, dried in the air, and a little salted; and of this even their horses sometimes partake. Being always in the saddle, they fancy they cannot make the slightest excursion on foot. We found an old negro slave, who managed the farm in the absence of his master. He told us of herds composed of several thousand cows, that were grazing in the steppes; yet we asked in vain for a bowl of milk. We were offered, in a calabash, some yellow, muddy, and fetid water, drawn from a neighbouring pool. The indolence of the inhabitants of the Llanos is such that they do not dig wells, though they know that almost everywhere, at ten feet deep, fine springs are found in a stratum of conglomerate, or red sandstone. After suffering during one half of the year from the effect of inundations, they quietly resign themselves, during the other half, to the most distressing deprivation of water. The old negro advised us to cover the cup with a linen cloth, and drink as through a filter, that we might not be incommoded by the smell, and might swallow less of the yellowish mud suspended in the water. We did not then think that we should afterwards be forced, during whole months, to have recourse to this expedient. The waters of the Orinoco are always loaded with earthy particles; they are even putrid, where dead bodies of alligators are found in the creeks, lying on banks of sand, or half-buried in the mud.

No sooner were our instruments unloaded and safely placed, than our mules were set at liberty to go, as they say here, para buscar agua, that is, "to search for water." There are little pools round the farm, which the animals find, guided by their instinct, by the view of some scattered tufts of mauritia, and by the sensation of humid coolness, caused by little currents of air amid an atmosphere which to us appears calm and tranquil. When the pools of water are far distant, and the people of the farm are too lazy to lead the cattle to these natural watering-places, they confine them during five or six hours in a very hot stable before they let them loose. Excess of thirst then augments their sagacity, sharpening as it were their senses and their
instinct. No sooner is the stable opened, than the horses and mules, especially the latter (for the penetration of these animals exceeds the intelligence of the horses), rush into the savannahs. With upraised tails and heads thrown back they run against the wind, stopping from time to time as if exploring space; they follow less the impressions of sight than of smell; and at length announce, by prolonged neighings, that there is water in the direction of their course. All these movements are executed more promptly, and with readier success, by horses born in the Llanos, and which have long enjoyed their liberty, than by those that come from the coast, and descend from domestic horses. In animals, for the most part, as in man, the quickness of the senses is diminished by long subjection, and by the habits that arise from a fixed abode and the progress of cultivation.

We followed our mules in search of one of those pools, whence the muddy water had been drawn, that so ill quenched our thirst. We were covered with dust, and tanned by the sandy wind, which burns the skin even more than the rays of the sun. We longed impatiently to take a bath, but we found only a great pool of feculent water, surrounded with palm-trees. The water was turbid, though, to our great astonishment, a little cooler than the air. Accustomed during our long journey to bathe whenever we had an opportunity, often several times in one day, we hastened to plunge into the pool. We had scarcely begun to enjoy the coolness of the bath, when a noise which we heard on the opposite bank, made us leave the water precipitately. It was an alligator plunging into the mud.

We were only at the distance of a quarter of a league from the farm, yet we continued walking more than an hour without reaching it. We perceived too late that we had taken a wrong direction. Having left it at the decline of day, before the stars were visible, we had gone forward into the plain at hazard. We were, as usual, provided with a compass, and it might have been easy for us to steer our course from the position of Canopus and the Southern Cross; but unfortunately we were uncertain whether, on leaving the farm, we had gone towards the east or the south. We attempted to return to the spot where we had bathed,
and we again walked three quarters of an hour without finding the pool. We sometimes thought we saw fire on the horizon; but it was the light of the rising stars enlarged by the vapours. After having wandered a long time in the savannah, we resolved to seat ourselves beneath the trunk of a palm-tree, in a spot perfectly dry, surrounded by short grass; for the fear of water-snakes is always greater than that of jaguars among Europeans recently disembarked. We could not flatter ourselves that our guides, of whom we knew the insuperable indolence, would come in search of us in the savannah before they had prepared their food and finished their repast. Whilst somewhat perplexed by the uncertainty of our situation, we were agreeably affected by hearing from afar the sound of a horse advancing towards us. The rider was an Indian, armed with a lance, who had just made the rodeo, or round, in order to collect the cattle within a determinate space of ground. The sight of two white men, who said they had lost their way, led him at first to suspect some trick. We found it difficult to inspire him with confidence; he at last consented to guide us to the farm of the Cayman, but without slackening the gentle trot of his horse. Our guides assured us that "they had already begun to be uneasy about us;" and, to justify this inquietude, they gave a long enumeration of persons who, having lost themselves in the Llanos, had been found nearly exhausted. It may be supposed that the danger is imminent only to those who lose themselves far from any habitation, or who, having been stripped by robbers, as has happened of late years, have been fastened by the body and hands to the trunk of a palm-tree.

In order to escape as much as possible from the heat of the day, we set off at two in the morning, with the hope of reaching Calabozo before noon, a small but busy tradingtown, situated in the midst of the Llanos. The aspect of the country was still the same. There was no moonlight; but the great masses of nebulm that spot the southern sky enlighten, as they set, a part of the terrestrial horizon. The solemn spectacle of the starry vault, seen in its immense expanse;-the cool breeze which blows over the plain during the night:-the waving motion of the grass, wherever it has attained any height; everything recalled to our minds the
surface of the ocean. The illusion was augmented when the disk of the sun appearing on the horizon, repeated its image by the effects of refraction, and, soon losing its flattened form, ascended rapidly and straight towards the renith.
Sunrise in the plains is the coolest moment of the day; but this change of temperature does not make a very lively impression on the organs. We did not find the thermo, meter in general sink below 27.5 ; while near Acapulco, at Mexico, and in places equally low, the temperature at noon is often $32^{\circ}$, and at sunrise only $17^{\circ}$ or $18^{\circ}$. The level surface of the ground in the Llanos, which, during the day, is never in the shade, absorbs so much heat that, notwithstanding the nocturnal radiation toward a sky without clouds, the earth and air have not time to cool very sensibly from midnight to sunrise.
In proportion as the sun rose towards the zenith, and the earth and the strata of superincumbent air took different temperatures, the phenomenon of the mirage displayed itself in its numerous modifications. This phenomenon is so common in every zone, that I mention it only because we stopped to measure with some precision the breadth of the aërial distance between the horizon and the suspended object. There was a constant suspension, without inversion. The little currents of air that swept the surface of the soil had so variable a temperature that, in a drove of wild oxen, one part appeared with the legs raised above the surface of the ground, while the other rested on it. The aërial distance was, according to the distance of the animal, from $3^{\prime}$ to $4^{\prime}$. Where tufts of the moriche palm were found growing in long ranges, the extremities of these green rows were suspended like the capes which were, for so long a time, the subject of my observations at Cumana. A well-informed person assured us, that he had seen, between Calabozo and Uritucu, the image of an animal inverted, without there being, any direct image. Niebuhr made a similar observation in Arabia. We several times thought we saw on the horizon the figures of tumuli and towers, which disappeared at intervals, without our being able to discern the real shape of the objects. They were perhaps hillocks, or small eminences, situated beyond the
ordinary visual horizon. I need not mention those tracts destitute of vegetation, which appear like large lakes with an undulating surface. This phenomenon, observed in very remote times, has occasioned the mirage to receive in Sanscrit the expressive name of desire of the antelope. We admire the frequent allusions in the Indian, Persian, and Arabic poets, to the magical effects of terrestrial refraction. It was scarcely known to the Greeks and Romans. Proud of the riches of their soil, and the mild temperature of the air, they would have felt no envy of this poetry of the desert. It had its birth in Asia; and the oriental poets found its source in the nature of the country they inhabited. They were inspired with the aspect of those vast solitudes, interposed like arms of the sea or gulfs, between lands which nature had adorned with her most luxuriant fertility.

The plain assumes at sunrise a more animated aspect. The cattle, which had reposed during the night along the pools, or beneath clumps of mauritias and rhopalas, were now collected in herds; and these solitudes became peopled with horses, mules, and oxen, that live here free, rather than wild, without settled habitations, and disdaining the care and protection of man. In these hot climates, the oxen, though of Spanish breed, like those of the cold table-lands of Quito, are of a gentle disposition. A traveller runs no risk of being attacked or pursued, as we often were in our excursions on the back of the Cordilleras, where the climate is rude, the aspect of the country more wild, and food less abundant. As we approached Calabozo, we saw herds of roebucks browsing peacefully in the midst of horses and oxen. They are called matacani; their flesh is good; they are a little larger than our roes, and resemble deer with a very sleek skin, of a fawn-colour, spotted with white. Their horns appear to me to have single points. They had little fear of the presence of man: and in herds of thirty or forty we observed several that were entirely white. This variety, common enough among the large stags of the cold climates of the Andes, surprised us in these low and burning plains. I have since learned, that even the jaguar, in the hot regions of Paraguay, sometimes affords albino varieties, the skin of which is of such uniform white-
ness that the spots or rings can be distinguished only in the sunshine. The number of matacani, or little deer, ${ }^{\text {* }}$ is so considerable in the Llanos, that a trade might be carried on with their skins. $\dagger$ A skilful hunter could easily kill more than twenty in a day; but such is the indolence of the inhabitants, that often they will not give themselves the trouble of taking the skin. The same indifference is evinced in the chase of the jaguar, a skin of which fetches only one piastre in the steppes of Varinas, while at Cadiz it costs four or five.

The steppes that we traversed are principally covered with grasses of the genera Killingia, Cenchrus, and Paspalum. $\ddagger$ At this season, near Calabozo and San Jerome del Pirital, these grasses scarcely attain the height of nine or ten inches. Near the banks of the Apure and the Portuguesa they rise to four feet in height, so that the jaguar can conceal himself among them, to spring upon the mules and horses that cross the plain. Mingled with these gramina some plants of the dicotyledonous class are found; as turneras, malvaceæ, and, what is very remarkable, little mimosas with irritable leaves, $\|$ called by the Spaniards dormideras. The same breed of cows, which fatten in Europe on sainfoin and clover, find excellent nourishment in the herbaceous sensitive plants. The pastures where these shrubs particularly abound are sold at a higher price than others. To the east, in the llanos of Cari and Barcelona, the cypura and the craniolaria,§ the beautiful white flower of which is from six to eight inches long, rise solitarily amid the gramina. The pastures are richest not only around the rivers subject to inundations, but also wherever the trunks of palm-trees are near each other. The least fertile spots are those destitute of trees; and attempts to cultivate them would be nearly fruitless. We cannot attri-

[^219]bute this difference to the shelter afforded by the palm-trees, in preventing the solar rays from drying and burning up the soil. I have seen, it is true, trees of this family, in the forests of the Orinoco, spreading a tufted foliage; but we cannot say much for the shade of the palm-tree of the llanos, the palma de cobija," which has but a few folded and palmate leaves, like those of the chamærops, and of which the lowermost are constantly withered. We were surprised to see that almost all these trunks of the corypha were nearly of the same size, viz., from twenty to twenty-four feet high, and from eight to ten inches diameter at the foot. Nature has produced few species of palm-trees in such prodigious numbers. Amidst thousands of trunks loaded with oliveshaped fruits we found about one hundred without fruit. May we suppose that there are some trees with flowers purely monoecious, mingled with others furnished with hermaphrodite flowers?

The Llaneros, or inhabitants of the plains, believe that all these trees, though so low, are many centuries old. Their growth is almost imperceptible, being scarcely to be noticed in the lapse of twenty or thirty years. The wood of the palma de cobija is excellent for building. It is so hard, that it is difficult to drive a nail into it. The leaves, folded like a fan, are employed to cover the roofs of the huts scattered through the Llanos; and these roofs last more than twenty years. The leaves are fixed by bending the extremity of the footstalks, which have been beaten beforehand between two stones, so that they may bend without breaking.

Beside the solitary trunks of this palm-tree, we find dispersed here and there in the steppes a few clumps, real groves (palmares), in which the corypha is intermingled with a tree of the proteaceous family, called chaparro by the natives. It is a new species of rhopala, t with hard and resonant leaves. The little groves of rhopala are called chaparales; and it may be supposed that, in a vast plain, where only two or three species of trees are to be found,

[^220]the chaparro, which affords shade, is considered a highly valuable plant. The corypha spreads through the Llanos of Caracas from Mesa de Peja as far as Guayaval; farther north and north-west, near Guanare and San Carlos, its place is taken by another species of the same genus, with leaves alike palmate but larger. It is called the 'royal palm of the plains' (palma real de los Llanos).* Other palm-trees rise south of Guayaval, especially the piritu with pinnate leaves, $t$ and the moriche (Mauritia flexuosa), celebrated by Father Gumilla under the name of arbol de la vida, or tree of life. It is the sago-tree of America, furnishing flour, wine, thread for weaving hammocks, baskets, nets, and clothing. Its fruit, of the form of the cones of the pine, and covered with scales, perfectly resembles that of the Calamus rotang. It has somewhat the taste of the apple. When arrived at its maturity it is yellow within and red without. The araguato monkeys eat it with avidity; and the nation of the Guaraounos, whose whole existence, it may be said, is closely linked with that of the moriche palmtree, produce from it a fermented liquor, slightly acid, and extremely refreshing. This palm-tree, with its large shining leaves, folded like a fan, preserves a beautiful verdure at the period of the greatest drought. The mere sight of it produces an agreeable sensation of coolness, and when loaded with scaly fruit, it contrasts singularly with the mournful aspect of the palma de cobija, the foliage of which is always grey and covered with dust. The Llaneros believe that the former attracts the vapours in the air; $\ddagger$ and that for this reason, water is constantly found at its foot, when dug for to a certain depth. The effect is confounded with the cause. The moriche grows best in moist places; and it may rather be said that the water attracts the tree. The natives of the Orinoco, by analogous reasoning, admit, that the great serpents contribute to preserve humidity in a province. "You would look in vain for water-serpents," said an old

[^221]Indian of Javita to us gravely, "where there are no marshes; because the water ceases to collect when you imprudently kill the serpents that attract it."

We suffered greatly from the heat in crossing the Mesa de Calabozo. The temperature of the air augmented sensibly every time that the wind began to blow. The air was loaded with dust; and during these gusts the thermometer rose to $40^{\circ}$ or $41^{\circ}$. We went slowly forward, for it would have been dangerous to leave the mules that carried our instruments. Our guides advised us to fill our hats with the leaves of the rhopala, to diminish the action of the solar rays on the hair and the crown of the head. We found relief from this expedient, which was particularly agreeable, when we could procure the thick leaves of the pothos or some other similar plant.

It is impossible to cross these burning plains, without inquiring whether they have always been in the same state; or whether they have been stripped of their vegetation by some revolution of nature. The stratum of mould now found on them is in fact very thin. The natives believe that the palmares and the chaparales (the little groves of palm-trees and rhopala) were more frequent and more extensive before the arrival of the Spaniards. Since the Llanos have been inhabited and peopled with cattle become wild, the savannah is often set on fire, in order to ameliorate the pasturage. Groups of scattered trees are accidently destroyed with the grasses. The plains were no doubt less bare in the fifteenth century, than they now are; yet the first Conquistadores, who came from Coro, described them then as savannahs, where nothing could be perceived but the sky and the turf, generally destitute of trees, and difficult to traverse on account of the reverberation of heat from the soil. Why does not the great forest of the Orinoco extend to the north, on the left bank of that river? Why does it not fill that vast space that reaches as far as the Cordillera of the coast, and which is fertilized by numerous rivers? These questions are connected with all that relates to the history of our planet. If, indulging in geological reveries, we suppose that the steppes of America, and the desert of Sahara, have been stripped of their vegetation by an irruption of the ocean, or that they formed originally the
bottom of an inland sea, we may conceive that thousands of years have not sufficed for the trees and shrubs to advance from the borders of the forests, from the skirts of the plains either naked or covered with turf, toward the centre, and: darken so vast a space with their shade. It is more difficult to explain the origin of bare savannahs, encircled by forests, than to recognize the causes that maintain forests and savannahs within their ancient limits, like continents and seas.

We found the most cordial hospitality at Calabozo, in the house of the superintendent of the royal plantations, Don Miguel Cousin. The town, situated between the banks of the Guarico and the Uritucu, contained at this period only five thousand inhabitants; but everything denoted increasing prosperity. The wealth of most of the inhabitants consists in herds, under the management of farmers, who are called hateros, from the word hato, which signifies in Spanish a house or farm placed in the midst of pastures. The scattered population of the Llanos being accumulated on certain points, principally around towns, Calabozo reckons already five villages or missions in its environs. It is computed, that 98,000 head of cattle wander in the pastures nearest to the town. It is very difficult to form an exact idea of the herds contained in the Llanos of Caracas, Barcelona, Cumana, and Spanish Guiana. M. Depons, who lived in the town of Caracas longer than I, and whose statistical statements are generally accurate, reckons in those vast plains, from the mouths of the Orinoco to the lake of Maracaybo, 1,200,000 oxen, 180,000 horses, and 90,000 mules. He estimates the produce of these herds at $5,000,000$ francs; adding to the value of the exportation the price of the hides consumed in the country. There exist, it is believed, in the Pampas of Buenos Ayres, 12,000,000 cows, and $3,000,000$ horses, without comprising in this enumemeration the cattle that have no acknowledged proprietor.
1 shall not hazard any general estimates, which from their nature are too uncertain; but shall only observe that, in the Llanos of Caracas, the proprietors of the great hatos are entirely ignorant of the number of the cattle they possess. They only know that of the young cattle, which are branded every year with a letter or mark peculiar to each herd. The richest proprietors mark as many as 14,000 head every
year; and sell to the number of five or six thousand. According to official documents, the exportation of hides from the whole capitania-general of Caracas amounted annually to 174,000 skins of oxen, and 11,500 of goats. When we reflect, that these documents are taken from the books of the custom-houses, where no mention is made of the fraudulent dealings in hides, we are tempted to believe that the estimate of $1,200,000$ oxen wandering in the Llanos, from the Rio Carony and the Guarapiche to the lake of Maracaybo, is much underrated. The port of La Guayra alone exported annually from 1789 to 1792, 70,000 or 80,000 hides, entered in the custom-house books, scarcely one-fifth of which was sent to Spain. The exportation from Buenos Ayres, at the end of the eighteenth century, was, according to Don Felix de Azara, 800,000 skins. The hides of Caracas are preferred in the Peninsula to those of Buenos Ayres; because the latter, on account of a longer passage, undergo a loss of twelve per cent. in the tanning. The southern part of the savannahs, commonly called the Upper Plains (Llanos de arriba), is very productive in mules and oxen; but the pasturage being in general less good, these animals are obliged to be sent to other plains to be fattened before they are sold. The Llano de Monai, and all the Lower Plains (Llanos de abaxo), abound less in herds, but the pastures are so fertile, that they furnish meat of an excellent quality for the supply of the coast. The mules, which are not fit for labour before the fifth year, are purchased on the spot at the price of fourteen or eighteen piastres. The horses of the Llanos, descending from the fine Spanish breed, are not very large; they are generally of a uniform colour, brown bay, like most of the wild animals. Suffering alternately from drought and floods, tormented by the stings of insects and the bites of the large bats, they lead a sorry life. After having enjoyed for some months the care of man, their good qualities are developed. Here there are no sheep: we saw flocks only on the table-land of Quito.

The hatos of oxen have suffered considerably of late from troops of marauders, who roam over the steppes killing the animals merely to take their hides. This robbery has increased since the trade of the Lower Orinoco has become
more flourishing. For half a century, the banks of that great river, from the mouth of the Apure as far as Angostura, were known only to the missionary-monks. The exportatation of cattle took place from the ports of the northern coast only, viz. from Cumana, Barcelona, Burburata, and Porto Cabello. This dependence on the coast is now much diminished. The southern part of the plains has established an internal communication with the Lower Orinoco; and this trade is the more brisk, as those who devote themselves to it easily escape the trammels of the prohibitory laws.
The greatest herds of cattle in the Llanos of Caracas are those of the hatos of Merecure, La Cruz, Belen, Alta Gracia, and Pavon. The Spanish cattle came from Coro and Tocuyo into the plains. History has preserved the name of the colonist who first conceived the idea of peopling these pasturages, inhabited only by deer, and a large species of cavy. Christoval Rodriguez sent the first horned cattle into the Llanos, about the year 1548. He was an inhabitant of the town of Tocuyo, and had long resided in New Grenada.
When we hear of the 'innumerable quantity' of oxen, borses, and mules, that are spread over the plains of America, we seem generally to forget that in civilized Europe, on lands of much less extent, there exist, in agricultural countries, quantities no less prodigious. France, according to M. Peuchet, feeds $6,000,000$ large horned cattle, of which $3,500,000$ are oxen employed in drawing the plough. In the Austrian monarchy, the number of oxen, cows, and calves, has been estimated at $13,400,000$ head. Paris alone consumes annually 155,000 horned cattle. Germany receives 150,000 oxen yearly from Hungary. Domestic animals, collected in small herds, are considered by agricultural nations as a secondary object in the riches of the state. Accordingly they strike the imagination much less than those wandering droves of oxen and horses which alone fill the uncultivated tracts of the New World. Civilization and social order favour alike the progress of population, and the multiplication of animals useful to man.
We found at Calabozo, in the midst of the Llanos, an electrical machine with large plates, electrophori, batteries,
*The thick-nosed tapir, or river cavy (Cavia capybara), called eliguire in thowe countries.
electrometers; an apparatus nearly as complete as our first scientific men in Europe possess. All these articles had not been purchased in the United States; they were the work of a man who had never seen any instrument, who had no person to consult, and who was acquainted with the phenomena of electricity only by reading the treatise of De Lafond, and Franklin's Memoirs. Señor Carlos del Pozo, the name of this enlightened and ingenious man, had begun to make cylindrical electrical machines, by employing large glass jars, after having cut off the necks. It was only within a few years he had been able to procure, by way of Philadelphia, two plates, to construct a plate machine, and to obtain more considerable effects. It is easy to judge what difficulties Señor Pozo had to encounter, since the first works upon electricity had fallen into his hands, and that he had the courage to resolve to procure himself, by his own industry, all that he had seen described in his books. Till now he had enjoyed only the astonishment and admiration produced by his experiments on persons destitute of all information, and who had never quitted the solitude of the Llanos; our abode at Calabozo gave him a satisfaction altogether new. It may be supposed that he set some value on the opinions of two travellers who could compare his apparatus with those constructed in Europe. I had brought with me electrometers mounted with straw, pith-balls, and gold-leaf; also a small Leyden jar which could be charged by friction according to the method of Ingenhousz, and which served for my physiological experiments. Señor del Pozo could not contain his joy on seeing for the first time instruments which he had not made, yet which appeared to be copied from his own. We also showed him the effect of the contact of heterogeneous metals on the nerves of frogs. The name of Galvani and Volta had not previously been heard in those vast solitudes.

Next to his electrical apparatus, the work of the industry and intelligence of an inhabitant of the Llanos, nothing at Calabozo excited in us so great an interest as the gymnoti, which are animated electrical apparatuses. I was impatient, from the time of my arrival at Cumana, to procure electrical eels. We had been promised them often, but our hopes had always been disappointed. Money loses its value as
you withdraw from the coast; and how is the imperturbable apathy of the ignorant people to be vanquished, when they are not excited by the desire of gain?
The Spaniards confound all electric fishes under the name of tembladores.* There are some of these in the Caribbean Sea, on the coast of Cumana. The Guayquerie Indians, who are the most skilful and active fishermen in those parts, brought us a fish, which, they said, benumbed their hands. This fish ascends the little river Manzanares. It is a new species of ray, the lateral spots of which are scarcely visible, and which much resembles the torpedo. The torpedos, which are furnished with an electric organ externally visible, on account of the transparency of the skin, form a genus or subgenus different from the rays properly so called. $\dagger$ The torpedo of Cumana was very lively, very energetic in its muscular movements, and yet the electric shocks it gave us were extremely feeble. They became stronger on galvanizing the animal by the contact of zinc and gold. Other tembladores, real gymnoti or electric eels, inhabit the Rio Colorado, the Guarapiche, and several little streams which traverse the Missions of the Chayma Indians. They abound also in the large rivers of America, the Orinoco, the Amazon, and the Meta; but the force of the ${ }^{-}$ currents and the depth of the water, prevent them from being caught by the Indians. They see these fish less frequently than they feel shocks from them when swimming or bathing in the river. In the Llanos, particularly in the environs of Calabozo, between the farms of Morichal and the Upper and Lower Missions, the basins of stagnant water and the confluents of the Orinoco (the Rio Guarico and the caños Rastro, Berito, and Paloma) are filled with electric eels. We at first wished to make our experiments in the house we inhabited at Calabozo; but the dread of the shocks caused by the gymnoti is so great, and so exag-

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gerated among the common people, that during three days we could not obtain one, though they are easily caught, and we had promised the Indians two piastres for every strong and vigorous fish. This fear of the Indians is the more extrordinary, as they do not attempt to adopt precautions in which they profess to have great confidence. When interrogated on the effect of the tembladores, they never fail to tell the Whites, that they may be touched with impunity while you are chewing tobacco. This supposed influence of tobacco on animal electricity is as general on the continent of South America, as the belief among mariners of the effect of garlic and tallow on the magnetic needle.

Impatient of waiting, and having obtained very uncertain results from an electric eel which had been brought to us alive, but much enfeebled, we repaired to the Caño de Bera, to make our experiments in the open air, and at the edge of the water. We set off on the 19th of March, at a very early hour, for the village of Rastro; thence we were conducted by the Indians to a stream, which, in the time of drought, forms a basin of muddy water, surrounded by fine trees," the clusia, the amyris, and the mimosa with fragrant flowers. To catch the gymnoti with nets is very difficult, on account of the extreme agility of the fish, which bury themselves in the mud. We would not employ the barbasco, that is to say, the roots of the Piscidea erithyrna, the Jacquinia armillaris, and some species of phyllanthus, which thrown into the pool, intoxicate or benumb the eels. These methods have the effect of enfeebling the gymnoti. The Indians therefore told us that they would "fish with horses," (embarbascar con caballos. $\dagger$ ) We found it difficult to form an idea of this extraordinary manner of fishing; but we soon saw our guides return from the savannah, which they had been scouring for wild horses and mules. They brought about thirty with them, which they forced to enter the pool.

The extraordinary noise caused by the horses' hoofs, makes the fish issue from the mud, and excites them to the attack. These yellowish and livid eels, resembling large

[^223]aquatic serpents, swim on the surface of the water, and crowd under the bellies of the horses and mules. A contest between animals of so different an organization presents a very striking spectacle. The Indians, provided with harpoons and long slender reeds, surround the pool closely; and some climb up the trees, the branches of which extend horizontally over the surface of the water. By their wild cries, and the length of their reeds, they prevent the horses from running away and reaching the bank of the pool. The eels, stunned by the noise, defend themselves by the repeated discharge of their electric batteries. For a long interval they seem likely to prove victorious. Several horses sink beneath the violence of the invisible strokes which they receive from all sides, in organs the most essential to life; and stunned by the force and frequency of the shocks, they disappear under the water. Others, panting, with mane erect, and haggard eyes expressing anguish and dismay, raise themselves, and endeavour to flee from the storm by which they are overtaken. They are driven back by the Indians into the middle of the water; but a small number succeed in eluding the active vigilence of the fishermen. These regain the shore, stumbling at every step, and stretch themselves on the sand, exhausted with fatigue, and with limbs benumbed by the electric shocks of the gymnoti.

In less than five minutes two of our horses were drowned. The eel being five feet long, and pressing itself against the belly of the horses, makes a discharge along the whole extent of its electric organ. It attacks at once the heart, the intestines, and the celiac fold of the abdominal nerves. It is natural that the effect felt by the horses should be more powerful than that produced upon man by the touch of the same fish at only one of his extremities. The horses are probably not killed, but only stunned. They are drowned from the impossibility of rising amid the prolonged struggle between the other horses and the eels.

We had little doubt that the fishing would terminate by killing successively all the animals engaged; but by degrees the impetuosity of this unequal combat diminished, and the wearied gymnoti dispersed. They require a long rest, and abundant nourishment, to repair the galvanic force which
they have lost.* The mules and horses appear less frightened; their manes are no longer bristled, and their eyes express less dread. The gymnoti approach timidly the edge of the marsh, where they are taken by means of small harpoons fastened to long cords. When the cords are very dry the Indians feel no shock in raising the fish into the air. In a few minutes we had five large eels, most of which were but slightly wounded. Some others were taken, by the same means, towards evening.

The temperature of the waters in which the gymnoti habitually live, is from $26^{\circ}$ to $27^{\circ}$. Their electric force diminishes it is said, in colder waters; and it is remarkable that, in general, animals endowed with electromotive organs, the effects of which are sensible to man, are not found in the air, butin a fluid that is a conductor of electricity. The gymnotus is the largest of electrical fishes. I measured some that were from five feet to five feet three inches long ; and the Indians assert that they have seen them still larger. We found that a fish of three feet ten inches long weighed twelve pounds. The transverse diameter of the body, without reckoning the anal fin, which is elongated in the form of a keel, was three inches and a half. The gymnoti of the Caño de Bera are of a fine olive-green. The under part of the head is yellow mingled with red. Two rows of small yellow spots are placed symmetrically along the back, from the head to the end of the tail. Every spot contains an excretory aperture. In consequence, the skin of the animal is constantly covered with a mucous matter, which, as Volta has proved, conducts electricity twenty or thirty times better than pure water. It is in general somewhat remarkable, that no electric fish yet discovered in the different parts of the world, is covered with scales. $\dagger$

[^224]The gymnoti, like our eels, are fond of swallowing and breathing air on the surface of the water; but we must not thence conclude that the fish would perish if it could not come up to breathe the air. The European eel will creep during the night upon the grass; but 1 have seen a very vigorous gymnotus that had sprung out of the water, die on the ground. M. Provençal and myself have proved by our researches on the respiration of fishes, that their humid bronchim perform the double function of decomposing the atmospheric air, and of appropriating the oxygen contained in water. They do not suspend their respiration in the air; but they absorb the oxygen like a reptile furnished with lungs. It is known that carp may be fattened by being fed, out of the water, if their gills are wet from time to time with humid moss, to prevent them from becoming dry. Fish separate their gill-covers wider in oxygen gas than in water. Their temperature however, does not rise; and they live the same length of time in pure vital air, and in a mixture of ninety parts nitrogen and ten oxygen. We found that tench placed under inverted jars filled with air, absorb half a cubic centimetre of oxygen in an hour. This action takes place in the gills only; for fishes on which a collar of cork has been fastened, and leaving their head out of the jar filled with air, do not act upon the oxygen by the rest of their body.

The swimming-bladder of the gymnotus is two feet five inches long in a fish of three feet ten inches. $\dagger$ It is separated by a mass of fat from the external skin; and rests upon the electric organs, which occupy more than two-thirds of
specifically different. The Indians mentioned to us a black and very powerful species, inhabiting the marshes of the Apure, which never attains a length of more than two feet, but which we were not able to procure. The raton of the Rio de la Magdalena, which I have described under the name of Gymnotus æquilabiatus (Observations de Zoologie, vol. i.) forms a particular sub-genus. This is a Carapa, not scaly, and without an electric organ. This organ is also entirely wanting in the Brazilian Carapo, and in all the rays which were carefully examined by Cuvier.

+ Cuvier has shown that in the Gymnotus electricus there exists, besides the large swimming. bladder, another situated before it, and much smaller. It looks like the bifurcated swimming-bladder in the Gymnotus equilabiatus.
the animal's body. The same vessels which penetrate between the plates or leaves of these organs, and which cover them with blood when they are cut transversely, also send out numerous branches to the exterior surface of the airbladder. I found in a hundred parts of the air of the swim-ming-bladder four of oxygen and ninety-six of nitrogen. The medullary substance of the brain displays but a feeble analogy with the albuninous and gelatinous matter of the electric organs. But these two substances have in common the great quantity of arterial blood which they receive, and which is deoxidated in them. We may again remark, on this occasion, that an extreme activity in the functions of the brain causes the blood to flow more abundantly towards the head, as the energy of the movement of the muscles accelerates the deoxidation of the arterial blood. What a contrast between the multitude and the diameter of the blood-vessels of the gymnotus, and the small space occupied by its muscular system! This contrast reminds the observer, that three functions of animal life, which appear in other respects sufficiently distinct,-the functions of the brain, those of the electrical organ, and those of the muscles, all require the afflux and concourse of arterial or oxygenated blood.

It would be temerity to expose ourselves to the first shocks of a very large and strongly irritated gymnotus. If by chance a stroke be received before the fish is wounded or wearied by long pursuit, the pain and numbness are so violent that it is impossible to describe the nature of the feeling they excite. I do not remember having ever received from the discharge of a large Leyden jar, a more dreadful shock than that which I experienced by imprudently placing both my feet on a gymnotus just taken out of the water. I was affected during the rest of the day with a violent pain in the knees, and in almost every joint. To be aware of the difference that exists between the sensation produced by the Voltaic battery and an electric fish, the latter should be touched when they are in a state of extreme weakness. The gymnoti and the torpedos then cause a twitching of the muscles, which is propagated from the part that rests on the electric organs, as far as the elbow. We seem to feel, at every stroke, an internal vibration, which lasts two or three seconds, and is followed by a painful numbness. Accord-
ingly, the Tamanac Indians call the gymnotus, in their expressive language, arimna, which means 'something that deprives of motion.'
The sensation caused by the feeble shocks of an electric eel appeared to me analogous to that painful twitching with which I have been seized at each contact of two heterogeneous metals applied to wounds which I had made on my back by means of cantharides. This difference of sensation between the effects of electric fishes and those of a Voltaic battery or a Leyden jar feebly charged has struck every observer; there is, however, nothing in this contrary to the supposition of the identity of electricity and the galvanic action of fishes. The electricity may be the same; but its effects will be variously modified by the disposition of the electrical apparatus, by the intensity of the fluid, by the rapidity of the current, and by the particular mode of action.

In Dutch Guiana, at Demerara for instance, electric eels were formerly employed to cure paralytic affections. At a time when the physicians of Europe had great confidence in the effects of electricity, a surgeon of Essequibo, named Van der Lott, published in Holland a treatise on the medical properties of the gymnotus. These electric remedies are practised among the savages of America, as they were among the Greeks. We are told by Scribonius Largus, Galen, and Dioscorides, that torpedos cure the headache and the gout. I did not hear of this mode of treatment in the Spanish colonies which I visited; and I can assert that, after having made experiments during four hours successively with gymnoti, M. Bonpland and myself felt, till the next day, a debility in the muscles, a pain in the joints, and a general uneasiness, the effect of a strong irritation of the nervous system.

The gymnotus is neither a charged conductor, nor a battery, nor an electromotive apparatus, the shock of which is received every time they are touched with one hand, or when both hands are applied to form a conducting circle between the opposite poles. The electric action of the fish depends entirely on its will; because it does not keep its electric organs always charged, or whether by the secretion of some fluid, or by any other means alike mysterious to us,
it be capable of directing the action of its organs to an external object. We often tried, both insulated and otherwise, to touch the fish, without feeling the least shock. When M. Bonpland held it by the head, or by the middle of the body, while I held it by the tail, and, standing on the moist ground, did not take each other's hand, one of us received shocks, which the other did not feel. It depends upon the gymnotus to direct its action towards the point where it finds itself most strongly irritated. The discharge is then made at one point only, and not at the neighbouring points. If two persons touch the belly of the fish with their fingers, at an inch distance, aud press it simultaneously, sometimes one, sometimes the other, will receive the shock. In the same manner, when one insulated person holds the tail of a vigorous gymnotus, and another pinches the gills or pectoral fin, it is often the first only by whom the shock is received. It did not appear to us that these differences could be attributed to the dryness or moisture of our hands, or to their unequal conducting power. The gymnotus seemed to direct its strokes sometimes from the whole surface of its body, sometimes from one point only. This effect indicates less a partial discharge of the organ composed of an innumerable quantity of layers, than the faculty which the animal possesses, (perhaps by the instantaneous secretion of a fluid spread through the cellular membrane, of establishing the communication between its organs and the skin only, in a very limited space.

Nothing proves more strongly the faculty, which the gymnotus possesses, of darting and directing its stroke at will, than the observations made at Philadelphia and Stockholm,* on gymnoti rendered extremely tame. When

[^225]they had been made to fast a long time, they killed small fishes put into the tnb. They acted from a distance; that is to say, their electrical shock passed through a very thick stratum of water. We need not be surprised that what was observed in Sweden, on a single gymnotus only, we could not perceive in a great number of individuals in their native country. The electric action of animals being a vital action, and subject to their will, it does not depend solely on their state of health and vigour. A gymnotus that has been kept a long time in captivity, accustoms itself to the imprisonment to which is is reduced; it resumes by degrees the same habits in the tub, which it had in the rivers and marshes. An electrical eel was brought to me at Calabozo: it had been taken in a net, and consequently having no wound. It ate meat, and terribly frightened the little tortoises and frogs which, not aware of their danger, placed themselves on its back. The frogs did not receive the stroke till the moment when they touched the body of the gymnotus. When they recovered, they leaped out of the tub; and when replaced near the fish, they were frightened at the mere sight of it. We then observed nothing that indicated an action at a distance ; but our gymnotus, recently taken, was not yet sufficiently tame to attack and devour frogs. On approaching the finger, or the metallic points, very close to the electric organs, no shock was felt. Perhaps the animal did not perceive the proximity of a foreign body; or, if it did, we must suppose that in the commencement of its captivity, timidity prevented it from darting forth its energetic strokes except when strongly irritated by an immediate contact. The gymnotus being immersed in water, I placed my hand; both armed and unarmed with metal, within a very small distance from the electric organs; yet the strata of water transmitted no shock, while M. Bonpland irritated the animal strongly by an immediate contact, and
of water, more or leas thick according to the distance, opposed to the electrical current. When very much pressed by hunger, it sometimes directed the shocks against the person who daily brought its food of boiled meat. Persons afflicted with rheumatism came to touch it in hopes of being cured. They took it at once by the neck and tail : the shocks were in this case stronger than when touched with one hand only. It almost entirely lost its electrical power a short time before its death."
received some very violent shocks. Had we placed a very delicate electroscope in the contiguous strata of water, it might possibly have deen influenced at the moment when the gymnotus seemed to direct its stroke elsewhere, Prepared frogs, placed immediately on the body of a torpedo, experience, according to Galvani, a strong contraction at every discharge of the fish.

The electrical organ of the gymnoti acts only under the immediate influence of the brain and the heart. On cutting a very vigorous fish through the middle of the body, the fore part alone gave shocks. These are equally strong in whatever part of the body the fish is touched; it is most disposed, however, to emit them when the pectoral fin, the electrical organ, the lips, the eyes, or the gills, are pinched. Sometimes the animal struggles violently with a person holding it by the tail, without communicating the least shock. Nor did I feel any when I made a slight incision near the pectoral fin of the fish, and galvanized the wound by the contact of two pieces of zinc and silver. The gymnotus bent itself convulsively, and raised its head out of the water, as if terrified by a sensation altogether new; but I felt no vibration in the hands which held the two metals. The most violent muscular movements are not always accompanied by electric discharges.

The action of the fish on the human organs is transmitted and intercepted by the same bodies that transmit and intercept the electrical current of a conductor charged by a Leyden jar, or Voltaic battery. Some anomalies, which we thought we observed, are easily explained, when we recollect that even metals (as is proved from their ignition when exposed to the action of the battery) present a slight obstacle to the passage of electricity; and that a bad conductor annihilates the effect, on our organs, of a feeble electric charge, whilst it transmits to us the effect of a very strong one. The repulsive force which zinc and silver exercise together being far superior to that of gold and silver, I have found that when a frog, prepared and armed with silver, is galvanized under water, the conducting arc of zinc produces contraction as soon as one of its extremities approaches the muscles within three lines distance; while an arc of gold does not excite the organs, when the
stratum of water between the gold and the muscles is more than half a line thick. In the same manner, by employing a conducting arc composed of two pieces of zinc and silver soldered together endways; and resting, as before, one of the extremities of the metallic circuit on the femoral nerve, it is necessary, in order to produce contractions, to bring the other extremity of the conductor nearer and nearer to the muscles, in proportion as the irritability of the organs diminishes. Toward the end of the experiment the slightest stratum of water prevents the passage of the electrical current, and it is only by the immediate contact of the arc with the muscles, that the contractions take place. These effects are, however, dependent on three variable circumstances; the energy of the electromotive apparatus, the conductibility of the medium, and the irritability of the organs which receive the impressions: it is because experiments have not been sufficiently multiplied with a riew to these three variable elements, that, in the action of electric eels and torpedos, accidental circumstances have been taken for absolute conditions, without which the electric shocks are not felt.

In wounded gymnoti, which give feeble but very equal shocks, these shocks appeared to us constantly stronger on touching the body of the fish with a hand armed with metal, than with the naked hand. They are stronger also, when, instead of touching the fish with one hand, naked, or armed with metal, we press it at once with both hands, either naked or armed. These differences become sensible ouly when one has gymnoti enough at disposal to be able to choose the weakest; and when the extreme equality of the electric discharges admits of distinguishing between the sensations felt alternately by the hand naked or armed with a metal, by one or both hands naked, and by one or both hands armed with metal. It is also in the case only of small shocks, feeble and uniform, that they are more sensible on touching the gymnotus with one hand (without forming a chain) with zinc, than with copper or iron.

Resinous substances, glass, very dry wood, horn, and even bones, which are generally believed to be good conductors, prevent the action of the gymnoti from being transmitted to man. I was surprised at not feeling the least shock on
pressing wet sticks of sealing-wax against the organs of the fish, while the same animal gave me the most violent strokes, when excited by means of a metallic rod. M. Bonpland received shocks, when carrying a gymnotus on two cords of the fibres of the palm-tree, which appeared to us extremely dry. A strong discharge makes its way through very imperfect conductors. Perhaps also the obstacle which the conductor presents renders the discharge more painful. I touched the gymnotus with a wet pot of brown clay, without effect; yet I received violent shocks when I carried the gymnotus in the same pot, because the contact was greater.

When two persons, insulated or otherwise, hold each other's hands, and only one of these persons touches the fish with the hand, either naked or armed with metal, the shock is most commonly felt by both at once. However, it sometimes happens that, in the most severe shocks, the person who comes into immediate contact with the fish alone feels them. When the gymnotus is exhausted, or in a very reduced state of excitability, and will no longer emit strokes on being irritated with one hand, the shocks are felt in a very vivid manner, on forming the chain, and employing both hands. Even then, however, the electric shock takes place only at the will of the animal. Two persons, one of whom holds the tail, and the other the head, cannot, by joining hands and forming a chain, force the gymnotus to dart his stroke.

Though employing the most delicate electrometers in rarious ways, insulating them on a plate of glass, and receiving very strong shocks which passed through the electrometer, I could never discover any phenomenon of attraction or repulsion. The same observation was made by M. Fahlberg at Stockholm. That philosopher, however, has seen an electric spark, as Walsh and Ingenhousz had before him, in London, by placing the gymnotus in the air, and interrupting the conducting chain by two gold leaves pasted upon glass, and a line distant from each other. No person, on the contrary, has ever perceived a spark issue from the body of the fish itself. We irritated it for a long time during the night, at Calabozo, in perfect darkness, without observing any luminous appearance. Having placed four
gymnoti, of unequal strength, in such a manner as to receive the shocks of the most vigorous fish by contact, that is to say, by touching only one of the other fishes, I did not observe that these last were agitated at the moment when the current passed their bodies. Perhaps the current did not penetrate below the humid surface of the skin. We will not, however, conclude from this, that the gymnoti are insensible to electricity; and that they cannot fight with each other at the bottom of the pools. Their nervous system must be subject to the same agents as the nerves of other animals. I have indeed seen, that, on laying open their nerves, they undergo muscular contractions at the mere contact of two opposite metals; and M. Fahlberg, of Stockholm, found that his gymnotus was convulsively agitated when placed in a copper vessel, and feeble discharges from a Leyden jar passed through its skin.

After the experiments I had made on gymnoti, it became highly interesting to me, on my return to Europe, to ascertain with precision the various circumstances in which another electric fish, the torpedo of our seas, gives or does not give shocks. Though this fish had been examined by numerous men of science, I found all that had been published on its electrical effects extremely vague. It has been very arbitrarily supposed, that this fish acts like a Leyden jar, which may be discharged at will, by touching it with both hands; and this supposition appears to have led into error observers who have devoted themselves to researches of this kind. M. Gay-Lussac and myself, during our journey to Italy, made a great number of experiments on torpedos taken in the gulf of Naples. These experiments furnish many results somewhat different from those I collected on the gymnoti. It is probable that the cause of these anomalies is owing rather to the inequality of electric power in the two fishes, than to the different disposition of their organs.

Though the power of the torpedo cannot be compared with that of the gymnotus, it is sufficient to cause very painful sensations. A person accustomed to electric shocks can with difficulty hold in his hands a torpedo of twelve or fourteen inches, and in possession of all its vigour. When the torpedo gives only very feeble strokes under water,
they become more sensible if the animal be raised above the surface. I have often observed the same phenomenon in experimenting on frogs.

The torpedo moves the pectoral fins convulsively every time it emits a stroke; and this stroke is more or less painful, according as the inmediate contact takes place by a greater or less surface. We observed that the gymnotus gives the strongest shocks without making any movement with the eyes, head, or fins.* Is this difference caused by the position of the electric organ, which is not double in the gymnoti? or does the movement of the pectoral fins of the torpedo directly prove that the fish restores the electrical equilibrium by its own skin, discharges itself by its own body, and that we generally feel only the effect of a lateral shock ?

We cannot discharge at will either a torpedo or a gymnotus, as we discharge at will a Leyden jar or a Voltaic battery. A shock is not always felt, even on touching the electric fish with both hands. We must irritate it to make it give the shock. This action in the torpedos, as well as in the gymnoti, is a vital action; it depends on the will only of the animal, which perhaps does not always keep its electric organs charged, or does not always employ the action of its nerves to establish the chain between the positive and negative poles. It is certain that the torpedo gives a long series of shocks with astonishing celerity; whether it is that the plates or laminæ of its organs are not wholly exhausted, or that the fish recharges them instantaneously.

The electric stroke is felt, when the animal is disposed to give it, whether we touch with a single finger only one of the surfaces of the organs, or apply both hands to the two surfaces, the superior and inferior, at once. In either case it is altogether indifferent whether the person who touches the fish with one finger or both hands be insulated or not. All that has been said on the necessity of a communication with the damp ground to establish a circuit, is founded on inaccurate observations.
M. Gay-Lussac made the important observation that when an insulated person touches the torpedo with one * The anal fin of the gymnoti only has a sensible motion when these fishes are excited under the belly, where the electric organ is placed.
finger, it is indispensible that the contact be direct. The fish may with impunity be touched with a key, or any other metallic instrument; no shock is felt when a conducting or non-conducting body is interposed between the finger and the electrical organ of the torpedo. This circumstance proves a great difference between the torpedo and the gymnotus, the latter giving his strokes through an iron rod several feet long.

When the torpedo is placed on a metallic plate of very little thickness, so that the plate touches the inferior surface of the organs, the hand that supports the plate never feels any shock, though another insulated person may excite the animal, and the convulsive movement of the pectoral fins may denote the strongest and most reiterated discharges.

If, on the contrary, a person support the torpedo placed upon a metallic plate, with the left hand, as in the foregoing experiment, and the same person touch the superior surface of the electrical organ with the right hand, a strong shock is then felt in both arms. The sensation is the same when the fish is placed between two metallic plates, the edges of which do not touch, and the persou applies both hands at once to these plates. The interposition of one metallic plate prevents the communication if that plate be touched with one hand only, while the interposition of two metallic plates does not prevent the shock when both hands are applied. In the latter case it cannot be doubted that the circulation of the fluid is established by the two arms.

If, in this situation of the fish between two plates, there exist any immediate communication between the edges of these two plates, no shock takes place. The chain between the two surfaces of the electric organ is then formed by the plates, and the new communication, established by the contact of the two hands with the two plates, remains without effect. We carried the torpedo with impunity between two plates of metal, and felt the strokes it gave only at the instant when they ceased to touch each other at the edges.

Nothing $m$ the torpedo or in the gymnotus indicates that the animal modifies the electrical state of the bodies by which it is surrounded. The most delicate electrometer is no way affected in whatever manner it is employed, whether
bringing it near the organs or insulating the fish, covering it with a metallic plate, and causing the plate to communicate by a conducting wire with the condenser of Volta. We were at great pains to vary the experiments by which we sought to render the electrical tension of the torpedo sensible; but they were constantly without effect, and perfectly confirmed what M. Bonpland and myself had observed respecting the gymnoti, during our abode in South America.

Electrical fishes, when very vigorous, act with equal energy under water and in the air. This observation led us to examine the conducting property of water; and we found that, when several persons form the chain between the superior and inferior surface of the organs of the torpedo, the shock is felt only when these persons join hands. The action is not intercepted if two persons, who support the torpedo with their right hands, instead of taking one another by the left hand, plunge each a metallic point into a drop of water placed on an insulating substance. On substituting flame for the drop of water, the communication is interrupted, and is only re-established, as in the gymnotus, when the two points immediately touch each other in the interior of the flame.

We are, doubtless, very far from having discovered all the secrets of the electrical action of fishes which is modified by the influence of the brain and the nerves; but the experiments we have just described are sufficient to prove that these fishes act by a concealed electricity, and by electromotive organs of a peculiar construction, which are recharged with extreme rapidity. Volta admits that the discharges of the opposite electricities in the torpedos and the gymnoti are made by their own skin, and that when we touch them with one hand only, or by means of a metallic point, we feel the effect of a lateral shock, the electrical current not being directed solely the shortest way. When a Leyden jar is placed on a wet woollen cloth (which is a bad conductor), and the jar is discharged in such a manner that the cloth makes part of the chain, prepared frogs, placed at different distances, indicate by their contractions that the current spreads itself over the whole cloth in a thousand different ways. According to this analogy, the most violent shock given by the gymnotus at a distance
would be but a feeble part of the stroke which re-establishes the equilibrium in the interior of the fish.* As the gymnotus directs its stroke wherever it pleases, it must also be admitted that the discharge is not made by the whole skin at once, but that the animal, excited perhaps by the motion of a fluid poured into one part of the cellular membrane, establishes at will the communication between its organs and some particular part of the skin. It may be conceived that a lateral stroke, out of the direct current, must become imperceptible under the two conditions of a very weak discharge, or a very great obstacle presented by the nature and length of the conductor. Notwithstanding these considerations, it appears to me very surprising that shocks of the torpedo, strong in appearance, are not propagated to the hand when a very thin plate of metal is interposed between it and the fish.

Schilling declared that the gymnotus approached the magnet involuntarily. We tried in a thousand ways this supposed influence of the magnet on the electrical organs, without having ever observed any sensible effect. The fish no more approached the magnet, than a bar of iron not magnetic. Iron-filings, thrown on its back, remained motionless.

The gymnoti, which are objects of curiosity and of the the deepest interest to the philosophers of Europe, are at once dreaded and detested by the natvies. They furnish, indeed, in their muscular flesh, pretty good aliment; but the electric organ fills the greater part of their body, and this organ is slimy, and disagreeable to the taste; it is

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accordingly separated with care from the rest of the eel. The presence of gymnoti is also considered as the principal cause of the want of fish in the ponds and pools of the Llanos. They, however, kill many more than they devour: and the Indians told us, that when young alligators and gymnoti are caught at the same time in very strong nets, the latter never show the slightest trace of a wound, because they disable the young alligators before they are attacked by them. All the inhabitants of the waters dread the society of the gymnoti. Lizards, tortoises, and frogs, seek pools where they are secure from the electric action. It became necessary to change the direction of a road near Uritucu, because the electric eels were so numerous in one river, that they every year killed a great number of mules, as they forded the water with their burdens.

Though in the present state of our knowledge we may flatter ourselves with having thrown some light on the extraordinary effects of electric fishes, yet a vast number of physical and physiological researches still remain to be made. The brilliant results which chemistry has obtained by means of the Voltaic battery, have occupied all observers, and turned attention for some time from the examinations of the phenomena of vitality. Let us hope that these phenomena, the most awful and the most mysterious of all, will in their turn occupy the earnest attention of natural philosophers. This hope will be easily realized if they succeed in procuring anew living gymnoti in some one of the great capitals of Europe. The discoveries that will be made on the electromotive apparatus of these fish, much more energetic, and more easy of preservation, than the torpedos,* will extend

[^227]to all the phenomena of muscular motion subject to volition. It will perhaps be found that, in most animals, every contraction of the muscular fibre is preceded by a discharge from the nerve into the muscle; and that the mere simple contact of heterogeneous substances is a source of movement and of life in all organized beings. Did an ingenious and lively people, the Arabians, guess from remote antiquity, that the same force which inflames the vault of Heaven in storms, is the living and invisible weapon of inhabitants of the waters? It is said, that the electric fish of the Nile bears a name in Egypt, that signifies thunder:*
We left the town of Calabozo on the 24th of March, highly satisfied with our stay, and the experiments we had made on an object so worthy of the attention of physiologists. I had besides obtained some good observations of the stars; and discovered with surprise, that the errors of maps amounted here also to a quarter of a degree of latitude. No person had taken an observation before me on this spot; and geographers, magnifying as usual the distance from the coast to the islands, have carried back beyond measure all the localities towards the south.
As we advanced into the southern part of the Llanos, we found the ground more dusty, more destitute of herbage, and more cracked by the effect of long drought. The palmtrees disappeared by degrees. The thermometer kept, from eleven in the morning till sunset, at $34^{\circ}$ or $35^{\circ}$. The calmer the air appeared at eight or ten feet high, the more we were enveloped in those whirlwinds of dust, caused by the little currents of air that sweep the ground. About four o'clock in the afternoon, we found a young Indian girl stretched upon the savannah. She was almost in a state of nudity, and appeared to be about twelve or thirteen years of age. Exhausted with fatigue and thirst, her eyes, nostrils, and mouth

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filled with dust, she breathed with a rattling in her throat, and was unable to answer our questions. A pitcher, overturned, and half filled with sand, was lying at her side. Happily one of our mules was laden with water; and we roused the girl from her lethargic state by bathing her face, and forcing her to drink a few drops of wine. She was at first alarmed on seeing herself surrounded by so many persons ; but by degrees she took courage, and conversed with our guides. She judged, from the position of the sun, that she must have remained during several hours in that state of.lethargy. We could not prevail on her to mount one of our beasts of burden, and she would not return to Uritucu. She had been in service at a neighbouring farm; and she had been discharged, because at the end of a long sickness she was less able to work than before. Our menaces and prayers were alike fruitless; insensible to suffering, like the rest of her race, she persisted in her resolution of going to one of the Indian Missions near the city of Calabozo. We removed the sand from her pitcher, and filled it with water. She resumed her way along the steppe, before we had remounted our horses, and was soon separated from us by a cloud of dust. During the night we forded the Rio Uritucu, which abounds with a breed of crocodiles remarkable for their ferocity. We were advised to prevent our dogs from going to drink in the rivers, for it often happens that the crocodiles of Uritucu come out of the water, and pursue dogs upon the shore. This intrepidity is so much the more striking, as at eight leagues distance, the crocodiles of the Rio Tisnao dre extremely timid, and little dangerous. The manners of animals vary in the same species according to local circumstances difficult to be determined. We were shown a hut, or rather a kind of shed, in which our host of Calabozo, Don Miguel Cousin, had witnessed a very extraordinary scene. Sleeping with one of his friends on a bench or couch covered with leather, Don Miguel was awakened early in the morning by a violent shaking and a horrible noise. Clods of earth were thrown into the middle of the hut. Presently a young crocodile two or three feet long issued from under the bed, darted at a dog which lay on the threshold of the door, and, missing him in the impetuosity of his spring, ran towards the beach to gain the river. On
examining the spot where the barbacoa, or couch, was placed, the cause of this strange adventure was easily discovered. The ground was disturbed to a considerable depth. It was dried mud, which had covered the crocodile in that state of lethargy, or summer-sleep, in which many of the species lie during the absence of the rains in the Llanos. The noise of men and horses, perhaps the smell of the dog, had aroused the crocodile. The hut being built at the edge of the pool, and inundated during part of the year, the crocodile had no doubt entered, at the time of the inundation of the savannahs, by the same opening at which it was seen to go out. The Indians often find enormous boas, which they call $u j i$, or water-serpents," in the same lethargic state. To reanimate them, they must be irritated, or wetted with water. Boas are killed, and immersed in the streams, to obtain, by means of putrefaction, the tendinous parts of the dorsal muscles, of which excellent guitar-strings are made at Calabozo, preferable to those furnished by the intestines of the alouate monkeys.

The drought and heat of the Llanos act like cold upon animals and plants. Beyond the tropics the trees lose their leaves in a very dry air. Reptiles, particularly crocodiles and boas, having very indolent habits, leave with reluctance the basins in which they have found water at the period of great inundations. In proportion as the pools become dry, these animals penetrate into the mud, to seek that degree of humidity which gives flexibility to their skin and integuments. In this state of repose they are seized with stupefaction; but possibly they preserve a communication with the external air ; and, however little that communication may be, it possibly suffices to keep up the respiration of an animal of the saurian family, provided with enormous pulmonary sacs, exerting no muscular motion, and in which almost all the vital functions are suspended. It is probable that the mean temperature of the dried mud, exposed to the solar rays, is more than $40^{\circ}$. When the north of Egypt, where the coolest month does not fall below $13.4^{\circ}$, was inhabited by crocodiles, they were often found torpid with cold. They were subject to a winter-sleep, like the Euro-

- Culebra de agua, named by the common people traga-venado, 'the swallower of stags.' The word uji belongs to the Tamanac language.
pean frog, lizard, sand-martin, and marnot. If the hibernal lethargy be observed, both in cold-blooded and in hotblooded animals, we shall be less surprised to learn, that these two classes furnish alike examples of a summer-sleep. In the same manner as the crocodiles of South America, the tanrecs, or Madagascar hedgehogs, in the midst of the torrid zone, pass three months of the year in lethargy.

On the 25th of March we traversed the smoothest part of the steppes of Caracas, the Mesa de Pavones. It is entirely destitute of the corypha and moriche palm-trees. As far as the eye can reach, not a single object fifteen inches high can be discovered. The air was clear, and the sky of a very deep blue; but the horizon reflected a livid and yellowish light, caused no doubt by the quantity of sand suspended in the atmosphere. We met some large herds of cattle, and with them flocks of birds of a black colour with an olive shade. They are of the genus Crotophaga,* and follow the cattle. We had often seen them perched on the backs of cows, seeking for gadflies and other insects. Like many birds of these desert places, they fear so little the approach of man, that children often catch them in their hands. In the valleys of Aragua, where they are very common, we have seen them perch upon the hammocks on which we were reposing, in open day.

We discover, between Calabozo, Uritucu, and the Mesa de Pavones, wherever there are excavations of some feet deep, the geological constitution of the Llanos. A formation of red sandstone (ancient conglomerate) covers an extent of several thousand square leagues. We shall find it again in the vast plains of the Amazon, on the eastern boundary of the province of Jaën de Bracamoros. This prodigious extension of red sandstone in the low grounds stretching along the east of the Andes, is one of the most striking phenomena I observed during my examination of rocks in the equinoctial regions.

The red sandstone of the Llanos of Caracas lies in a concave position, between the primitive mountains of the shore and of Parime. On the north it is backed by the

* The Spanish colonists call the Crotophaga ani, zamurito (little carrion valture,- Vultur aura minuta), or garapatero, 'the eater of garapatas,' insects of the Acarus family.
transition-slates,* and on the south it rests immediately on the granites of the Orinoco. We observed in it rounded fragments of quartz (kieselschiefer), and Lydian stone, cemented by an olive-brown ferruginous clay. The cement is sometimes of so bright a red that the people of the country take it for cinnabar. We met a Capuchin monk at Calabozo, who was in vain attempting to extract mercury from this red sandstone. In the Mesa de Paja this rock contains strata of another quartzose sandstone, very fine-grained; more to the south it contains masses of brown iron, and fragments of petrified trees of the monocotyledonous family, but we did not see in it any shells. The red sandstone, called by the Llaneros, the stone of the reefs (piedra de arrecifes), is everywhere covered with a stratum of clay. This clay, dried and hardened in the sun, splits into separate prismatic pieces with five or six sides. Does it belong to the trap-formation of Parapara? It becomes thicker, and mixed with sand, as we approach the Rio Apure; for near Calabozo it is one toise thick, near the mission of Guayaval five toises, which may lead to the belief that the strata of red sandstone dips towards the south. We gathered in the Mesa de Pavones little nodules of blue iron-ore disseminated in the clay.

A dense whitish-gray limestone, with a smooth fracture, somewhat analogous to that of Caripe, and consequently to that of Jura, lies on the' red sandstone between Tisnao and Calabozo. $\dagger$ In several other places, for instance in the Mesa de San Diego, and between Ortiz and the Mesa de Paja, $\ddagger$ we find above the limestone lamellar gypsum alternating with strata of marl. Considerable quantities of this gypsum are sent to the city of Caracas,§ which is situated amidst primitive mountains.

This gypsum generally forms only small beds, and is mixed with a great deal of fibrous gypsum. Is it of the

[^229]same formation as that of Guire, on the coast of Paria, which contains sulphur? or do the masses of this latter substance, found in the valley of Buen Pastor and on the banks of the Orinoco, belong, with the argillaceous gypsum of the Llanos, to a secondary formation much more recent.

These questions are very interesting in the study of the relative antiquity of rocks, which is the principal basis of geology. I know not of any salt-deposits in the Llanos. Horned cattle prosper here without those famous bareros, or muriatiferous lands, which abound in the Pampas of Buenos Ayres."

After having wandered for a long time, and without any traces of a road, in the desert savannahs of the Mesa de Pavones, we were agreeably surprised when we came to a solitary farm, the Hato de Alta Gracia, surrounded with gardens and basins of limpid water. Hedges of bead-trees encircled groups of icacoes laden with fruit. Farther on we passed the night near the small village of San Geronymo del Guayaval, founded by Capuchin missionaries. It is situated near the banks of the Rio Guarico, which falls into the Apure. I visited the missionary, who had no other habitation than his church, not haring yet built a house. He was a young man, and he received us in the most obliging manner, giving us all the information we desired. His village, or to use the word established among the monks, his Mission, was not easy to govern. The founder, who had not hesitated to establish for his own profit a pulperia, in other words, to sell bananas and guarapo in the church itself, had shown himself to be not very nice in the choice of the new colonists. Many marauders of the Llanos had settled at Guayaval, because the inhabitants of a Mission are exempt from the authority of secular law. Here, as in Australia, it cannot be expected that good colonists will be formed before the second or third generation.

We passsd the Guarico, and encamped in the savannahs south of Guayaval. Enormons bats, no doubt of the tribe of Phyllostomas, hovered as usual over our hammocks during a great part of the night. Every moment they seemed to be about to fasten on our faces. Early in the

[^230]morning we pursued our way over low grounds, often inundated. In the season of rains, a boat may be navigated, as on a lake, between the Guarico and the Apure. We arrived on the 27th of March at the Villa de San Fernando, the capital of the Mission of the Capuchins in the province of Varinas. This was the termination of our journey over the Llanos; for we passed the three months of April, May, and June on the rivers.

## Chapter XVIII.

San Fernando de Apure.-Intertwinings and Bifurcations of the Rivers Apure and Arauca.-Navigation on the Rio Apure.

THLL the second half of the eighteenth century the names of the great rivers Apure, Arauca, and Meta were scarcely known in Europe: certainly less than they had been in the two preceding centuries, when the valiant Felipe de Urre and the conquerors of Tocuyo traversed the Llanos, to seek, beyond the Apure, the great legendary city of El Dorado, and the rich country of the Omeguas, the Timbuctoo of the New Continent. Such daring expeditions could not be carried out without all the apparatus of war; and the weapons, which had been destined for the defence of the new colonists, were employed without intermission against the unhappy natives. When more peaceful times succesded to those of violence and public calamity, two powerful Indian tribes, the Cabres and the Caribs of the Orinoco, made themselves masters of the country which the Conquistadores had ceased to ravage. None but poor monks were then permitted to advance to the south of the steppes. Beyond the Uritucu an unknown world opened to the Spanish colonists; and the descendants of those intrepid warriors who had extended their conquests from Peru to the coasts of New Grenada and the mouth of the Amazon, knew not the roads that lead from Coro to the Rio Meta. The shore of Venezuela remained a separate country; and the slow conquests of the Jesuit missionaries were successful only by skirting the banks of the Orinoco. These
fathers had already penetrated beyond the great cataracts of Atures and Maypures, when the Andalusian Capuchins had scarcely reached the plains of Calabozo, from the coast and the valleys of Aragua. It would be difficult to explain these contrasts by the system according to which, the different monastic orders are governed; for the aspect of the country contributes powerfully to the more or less rapid progress of the Missions. They extend but slowly into the interior of the land, over mountains, or in steppes, wherever they do not follow the course of a particular river. It will scarcely be believed, that the Villa de Fernando de Apure, only fifty leagues distant in a direct line from that part of the coast of Caracas which has been longest inhabited, was founded at no earlier a date than 1789 . We were shown a parchment, full of fine paintings, containing the privileges of this little town. The parchment was sent from Madrid at the solicitation of the monks, whilst yet only a few huts of reeds were to be seen around a great cross raised in the centre of the hamlet. The missionaries and the secular governments being alike interested in exaggerating in Europe what they have done to augment the culture and population of the provinces beyond sea, it often happens that names of towns and villages are placed on the list of new conquests, long before their foundation.

The situation of San Fernando, on a large navigable river, near the mouth of another river which traverses the whole province of Varinas, is extremely advantageous for trade. Every production of that province, hides, cacao, cotton, and the indigo of Mijagual, which is of the first quality, passes through this town towards the mouths of the Orinoco. During the season of rains large vessels go from Angostura as far as San Fernando de Apure, and by the Rio Santo Domingo as far as Toruños, the port of the town of Varinas. At that period the inundations of the rivers, which form a labyrinth of branches between the Apure, the Aranca, the Capanaparo, and the Sinaruco, cover a country of nearly four hundred square leagues. At this point, the Orinoco, turned aside from its course, not by neighbouring mountains, but by the rising of counterslopes, runs eastward instead of following its previous direction in the line of the meridian. Considering the surface of the globe as a
polyhedron, formed of planes variously inclined, we may conceive by the mere inspection of the maps, that the intersection of these slopes, rising towards the north, the west, and south,* between San Fernando de Apure, Caycara, and the mouth of the Meta, must cause a considerable depression. The savannahs in this basin are covered with twelve or fourteen feet of water, and present, at the period of rains, the aspect of a great lake. The farms and villages which seem as if situated on shoals, scarcely rise two or three feet above the surface of the water. Everything here calls to mind the inundations of Lower Egypt, and the lake of Xarayes, heretofore so celebrated among geographers, though it exists only during some months of the year. The swellugs of the rivers Apure, Meta, and Orinoco, are also periodical. In the rainy season, the horses that wander in the savannah, and have not time to reach the rising grounds of the Llanos, perish by hundreds. The mares are seen, followed by their colts, $\dagger$ swimming during a part of the day to feed upon the grass, the tops of which alone wave above the waters. In this state they are pursued by the crocodiles, and it is by no means uncommon to find the prints of the teeth of these carnivorous reptiles on their thighs. The carcases of horses, mules, and cows, attract an innumerable quantity of vultures. The zamuros are the ibisis of this country, and they render the same service to the inhabitants of the Llanos as the Vultur percnopterus to the inhabitants of Egypt.

We cannot reflect on the effects of these inundations without admiring the prodigious pliability of the organization of the animals which man has subjected to his sway. In Greenland the dog eats the refuse of the fisheries; and when fish are wanting, feeds on seaweed. The ass and the

[^231]horse, originally natives of the cold and barren plains of Upper Asia, follow man to the New World, return to the wild state, and lead a restless and weary life in the burning climates of the tropics. Pressed alternately by excess of drought and of humidity, they sometimes seek a pool in the midst of a bare and dusty plain, to quench their thirst; and at other times flee from water, and the overflowing rivers, as menaced by an enemy that threatens them on all sides. Tormented during the day by gadflies and mosquitos, the horses, mules, and cows find themselves attacked at night by enormous bats, which fasten on their backs, and cause wounds that become dangerous, because they are filled with acaridæ and other hurtful insects. In the time of great drought the mules gnaw even the thorny cactus* in order to imbibe its cooling juice, and draw it forth as from a vegetable fountain. During the great inundations these same animals lead an amphibious life, surrounded by crocodiles, water-serpents, and manatis. Yet, such are the immutable laws of nature, that their races are preserved in the struggle with the elements, and amid so many sufferings and dangers. When the waters retire, and the rivers return again into their beds, the savannah is overspread with a beautiful scented grass; and the animals of Europe and Upper Asia seem to enjoy, as in their native climes, the renewed vegetation of spring.

During the time of great floods, the inhabitants of these countries, to avoid the force of the currents, and the danger arising from the trunks of trees which these currents bring down, instead of ascending the beds of rivers in their boats, cross the savannahs. To go from San Fernando to the villages of San Juan de Payara, San Raphael de Atamaica, or San Francisco de Capanaparo, they direct their course due south, as if they were crossing a single river of twenty leagues broad. The junctions of the Guarico, the Apure, the Cabullare, and the Arauca with the Orinoco, form, at a hundred and sixty leagues from the coast of Guiana, a kind of interior Delta, of which hydrography furnishes few examples in the Old World. According to the height of the

* The asses are particularly adroit in extracting the moisture contained in the Cactus melocatus. They push aside the thorns with their hoofs; but sometimes lame themselves in performing this feat.
mercury in the barometer, the waters of the Apure have only a fall of thirty-four toises from San Fernando to the sea. The fall from the mouths of the Osage and the Missouri to the bar of the Mississippi is not more considerable. The savannahs of Lower Louisiana everywhere remind us of the savannahs of the Lower Orinoco.

During our stay of three days in the little town of San Fernando, we lodged with the Capuchin missionary, who lived much at his ease. We were recommended to him by the bishop of Caracas, and he showed us the most obliging attention. He consulted me on the works that had been undertaken to prevent the flood from undermining the shore on which the town was built. The flowing of the Portuguesa into the Apure gives the latter an impulse towards southeast; and, instead of procuring a freer course for the river, attempts were made to confine it by dykes and piers. It was easy to predict that these would be rapidly destroyed by the swell of the waters, the shore having been weakened by taking away the earth from behind the dyke to employ it in these hydraulic constructions.

San Fernando is celebrated for the excessive heat which prevails there the greater part of the year; and before I begin the recital of our long navigation on the rivers, I shall relate some facts calculated to throw light on the meteorology of the tropics. We went, provided with thermometers, to the flat shores covered with white sand which border the river Apure. At two in the afternoon I found the sand, wherever it was exposed to the sun, at $52.5^{\circ}$. The instrument, raised eighteen inches above the sand, marked $42 \cdot 8^{\circ}$, and at six feet high $38 \cdot 7^{\circ}$. The temperature of the air under the shade of a ceiba was $36 \cdot 2^{\circ}$. These observations were made during a dead calm. As soon as the wind began to blow, the temperature of the air rose $3^{\circ}$ higher, yet we were not enveloped by a wind of sand, but the strata of air had been in contact with a soil more strongly heated, or through which whirlwinds of sand had passed. This western part of the Llanos is the hottest, because it receives air that has already crossed the rest of the barren steppe. The same difference has been observed between the eastern and western parts of the deserts of Africa, where the trade-winds blow.

The heat augments sensibly in the Llanos during the rainy season, particularly in the month of July, when the sky is cloudy, and reflects the radiant heat toward the earth. During this season the breeze entirely ceases; and, according to good thermometrical observations made by M. Pozo, the thermometer rises in the shade to $39^{\circ}$ and $395^{\circ}$, though kept at the distance of more than fifteen feet from the ground. As we approached the banks of the Portuguesa, the Apure, and the Apurito, the air became cooler from the evaporation of so considerable a mass of water. This effect is more especially perceptible at sunset. During the day the shores of the rivers, covered with white sand, reflect the heat in an insupportable degree, even more than the yellowish brown clayey grounds of Calabozo and Tisnao.

On the 28th of March I was on the shore at sunrise to measure the breadth of the Apure, which is two hundred and six toises. The thunder rolled in all directions around. It was the first storm and the first rain of the season. The river was swelled by the easterly wind; but it soon became calm, and then some great cetacea, much resembling the porpoises of our seas, began to play in long files on the surface of the water. The slow and indolent crocodiles seem to dread the neighbourhood of these animals, so noisy and impetuous in their evolutions, for we saw them dive whenever they approached. It is a very extraordinary phenomenon to find cetacea at such a distance from the coast. The Spaniards of the Missions designate them, as they do the porpoises of the ocean, by the name of toninas. The Tamanacs call them orinucna. They are three or four feet long; and bending their back, and pressing with their tail on the inferior strata of the water, they expose to view a part of the back and of the dorsal fin. I did not succeed in obtaining any, though I often engaged Indians to shoot at them with their arrows. Father Gili asserts that the Gumanos eat their flesh. Are these cetacea peculiar to the great rivers of South America, like the manati, which, according to Cuvier, is also a fresh water cetaceous animal? or must we admit that they go up from the sea against the current, as the beluga sometimes does in the rivers of Asia? What would lead me to doubt this last supposition is, that we saw toninas above the great cataracts
of the Orinoco, in the Rio Atabapo. Did they penetrate into the centre of equinoctial America from the mouth of the Amazon, by the communication of that river with the Rio Negro, the Cassiquiare, and the Orinoco? They are found here at all seasons, and nothing seems to denote that they make periodical migrations like salmon.

While the thunder rolled around us, the sky displayed only scattered clouds, that advanced slowly toward the zenith, and in an opposite direction. The hygrometer of Deluc was at $53^{\circ}$, the centigrade thermometer $23.7^{\circ}$, and Saussure's hygrometer $87.5^{\circ}$. The electrometer gave no sign of electricity. As the storm gathered, the blue of the sky changed at first to deep azure and then to grey. The vesicular vapour became visible, and the thermometer rose three degrees, as is almost always the case, within the tropics, from a cloudy sky which reflects the radiant heat of the soil. A heary rain fell. Being sufficieutly habituated to the climate not to fear the effect of tropical rains, we remained on the shore to observe the electrometer. I held it more than twenty minutes in my hand, six feet above the ground, and observed that in general the pith-balls separated only a few seconds before the lightning was seen. The separation was four lines. The electric charge remained the same during several minutes; and having time to determine the nature of the electricity, by approaching a stick of sealing-wax, I saw here what I had often observed on the ridge of the Andes during a storm, that the electricity of the atmosphere was first positive, then nil, and then negative. These oscillations from positive to negative were often repeated. Yet the electrometer constantly denoted, a little before the lightning, only E., or + E., and never - E. Towards the end of the storm the west wind blew very strongly. The clouds dispersed, and the thermometer sunk to $22^{\circ}$ on account of the evaporation from the soil, and the freer radiation towards the sky.

I have entered into these details on the electric charge of the atmosphere because travellers in general confine themselves to the description of the impressions produced on a European newly arrived by the solemn spectacle of a tropical storm. In a country where the year is divided into
great seasons of drought and wet, or, as the Indians say in their expressive language, of sun* and rain, $\dagger$ it is highly interesting to follow the progress of meteorological phenomena in the transition from one season to another. We had already observed, in the valleys of Aragua, from the 18th and 19th of February, clouds forming at the commencement of the night. In the beginning of the month of March the accumulation of the vesicular vapours, visible to the eye, and with them signs of atmospheric electricity, augmented daily. We saw flashes of heat-lightning to the south; and the electrometer of Volta constantly displayed, at sunset, positive electricity. The pith balls, unexcited during the day, separated to the width of three or four lines at the commencement of the night, which is triple what I generally observed in Europe, with the same instrument, in. calm weather. Upon the whole, from the 26th of May, the electrical equilibrium of the atmosphere seemed disturbed. During whole hours the electricity was nil, then it became very strong, and soon after was again imperceptible. The hygrometer of Deluc continued to indicate great dryness (from $33^{\circ}$ to $35^{\circ}$ ), and yet the atmosphere appeared no longer the same. Amidst these perpetual variations of the electric state of the air, the trees, divested of their foliage, already began to unfold new leaves, and seemed to feel the approach of spring.
The variations which we have just described are not peculiar to one year. Everything in the equinoctial zone has a wonderful uniformity of succession, because the active powers of nature limit and balance each other, according to laws that are easily recognized. I shall here note the progress of atmospherical phenomena in the islands to the east of the Cordilleras of Merida and of New Grenada, in the Llanos of Venezuela and the Rio Meta, from four to ten degrees of north latitude, wherever the rains are constant

* In the Maypure dialect camoti, properly "the heat [of the sun]." The Tamanacs call the season of drought uamu, "the time of grasshoppers."
$\dagger$ In the Tamanac language canepo. The year is designated, among several nations, by the name of one of the two seasons. The Maypures say, "so many suns," (or rather "so many heats;") the Thmanacs, "so many rains."
from May to October, and comprehending consequently the periods of the greatest heats, which occur in July and August.*

Nothing can equal the clearness of the atmosphere from the month of December to that of February. The sky is then constantly without clouds; and if one should appear, it is a phenomenon that engages the whole attention of the inhabitants. A breeze from the east, and from east-northeast, blows with violence. As it brings with it air always of the same temperature, the vapours cannot become visible by cooling.

About the end of February and the beginning of March, the blue of the sky is less intense, the hygrometer indicates by degrees greater humidity, the stars are sometimes veiled by a slight stratum of vapour, and their light is no longer steady and planetary; they are seen twinkling from time to time when at $20^{\circ}$ above the horizon. The breeze at this period becomes less strong, less regular, and is often interrupted by dead calms. The clouds accumulate towards south-south-east, appearing like distant mountains, with outlines strongly marked. From time to time they detach themselves from the horizon, and traverse the vault of the sky with a rapidity which little corresponds with the feeble wind prevailing in the lower strata of the air. At the end of March, the southern region of the atmosphere is illumined by small electric explosions. They are like phosphorescent gleams, circumscribed by vapour. The breeze then shifts from time to time, and for several hours together, to the west and south-west. This is a certain sign of the approach of the rainy season, which begins at the Orinoco about the end of April. The blue sky disappears, and a grey tint spreads uniformly over it. At the same time the heat of the atmosphere progressively increases; and soon the heavens are no longer obscured by clouds, but by condensed vapours. The plaintive cry of the howling apes begins to be heard before sunrise. The atmospheric electricity, which, during

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the season of drought, from December to March, had been constantly, in the day-time, from 1.7 to 2 lines, becomes extremely variable from the month of March. It appears nil during whole days; and then for some hours the pithballs diverge three or four lines. The atmosphere, which is generally, in the torrid as well as in the temperate zone, in a state of positive electricity, passes alternately, for eight or ten minutes, to the negative state. The season of rains is that of storms; and yet a great number of experiments made during three years, prove to me that it is precisely in this season of storms we find the smallest degree of electric tension in the lower regions of the atmosphere. Are storms the effect of this unequal charge of the different superincumbent strata of air? What prevents the electricity from descending towards the earth, in air which becomes more humid after the month of March? The electricity at this period, instead of being diffused throughout the whole atmosphere, appears accumulated on the exterior envelope, at the surface of the clouds. According to M. Gay-Lussac it is the formation of the cloud itself that carries the fluid toward its surface. The storm rises in the plains two hours after the sun has passed the meridian; consequently a short time after the moment of the maximum of diurnal heat within the tropics. It is extremely rare in the islands to hear thunder during the night, or in the morning. Storms at night are peculiar to certain valleys of rivers, having a peculiar climate.

What then are the causes of this rupture of the equilibrium in the electric tension of the air? of this continual condensation of the vapours into water? of this interruption of the breezes? of this commencement and duration of the rainy seasons? I doubt whether electricity have any influence on the formation of vapours. It is rather the formation of these vapours that augments and modifies the electrical tension. North and south of the equator, storms or great explosions take place at the same time in the temperate and in the equinoctial zone. Is there an action propagated through the great aeirial ocean from the temperate zone towards the tropics? How can it be conceived, that in that zone where the sun rises constantly to so great a height above the horizon, its passage through
the zenith can have so powerful an influence on the meteorological variations? I am of opinion that no local cause determines the commencement of the rains within the tropics; and that a more intimate knowledge of the higher currents of air will elucidate these problems, so complicated in appearance. We can observe only what passes in the lower strata of the atmosphere. The Andes are scarcely inhabited beyond the height of two thousand toises; and at that height the proximity of the soil, and the masses of mountains, which form the shoals of the aërial ocean, have a sensible influence on the ambient air. What we observe on the table-land of Antisana is not what we should find at the same height in a balloon, hovering over the Llanos or the surface of the ocean.

We have just seen that the season of rains and storms in the northern equinoctial zone coincides with the passage of the sun through the zenith of the place,* with the cessation of the north-east breezes, and with the frequency of calms and bendavales, which are stormy winds from south-east and south-west, accompanied by a cloudy sky. I believe that, in reflecting on the general laws of the equilibrium of the gaseous masses constituting our atmosphere, we may find, in the interruption of the current that blows from an homonymous pole, in the want of the renewal of air in the torrid zone, and in the continued action of an ascending humid current, a very simple cause of the coincidence of these phenomena, While the north-easterly breeze blows with all its violence north of the equator, it prevents the atmosphere which covers the equinoctial lands and seas from saturating itself with moisture. The hot and moist air of the torrid zone rises aloft, and flows off again towards the poles; while inferior polar currents, bringing drier and colder strata, are every instant taking the place of the columns of ascending air. By this constant action of two opposite currents, the humidity, far from being accumu-lated in the equatorial region, is carried towards the cold and temperate regions. During this season of breezes, which is that when the sun is in the southern signs, the

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sky in the northern equinoctial zone is constantly serene. The vesicular vapours are not condensed, because the air, unceasingly renewed, is far from the point of saturation. In proportion as the sun, entering the northern signs, rises towards the zenith, the breeze from the north-east moderates, and by degrees entirely ceases. The difference of temperature between the tropics and the temperate northern zone is then the least possible. It is the summer of the boreal pole; and, if the mean temperature of the winter, between $42^{\circ}$ and $52^{\circ}$ of north latitude, be from $20^{\circ}$ to $26^{\circ}$ of the centigrade thermometer less than the equatorial heat, the difference in summer is scarcely from $4^{\circ}$ to $6^{\circ}$. The sun being in the zenith, and the breeze having ceased, the causes which produce humidity, and accumulate it in the northern equinoctial zone, become at once more active. The column of air reposing on this zone, is saturated with vapours, because it is no longer renewed by the polar current. Clouds form in this air saturated and cooled by the combined effects of radiation and the dilatation of the ascending air. This air augments its capacity for heat in proportion as it rarefies. With the formation and collection of the vesicular vapours, electricity accumulates in the higher regions of the atmosphere. The precipitation of the vapours is continual during the day; but it generally ceases at night, and frequently even before sunset. The showers are regularly more violent, and accompanied with electric explosions, a short time after the maximum of the diurnal heat. This state of things remains unchanged, till the sun enters into the southern signs. This is the commencement of cold in the northern temperate zone. The current from the north-pole is then re-established, because the difference between the heat of the equinoctial and temperate regions augments daily. The north-east breeze blows with violence, the air of the tropics is renewed, and can no longer attain the degree of saturation. The rains consequently cease, the vesicular vapour is dissolved, and the sky resumes its elearness and its azure tint. Electrical explosions are no longer heard, doubtless because electricity no longer comes in contact with the groups of vesicular vapours in the high regions of the air, I had almost said the coating of clouds, on which the fluid can accumulate.

We have here considered the cessation of the breezes as the principal cause of the equatorial rains. These rains in each hemisphere last only as long as the sun has its declination in that hemisphere. It is necessary to observe, that the absence of the breeze is not always succeeded by a dead calm; but that the calm is often interrupted, particularly along the western coast of America, by bendavales, or southwest and south-east winds.' This phenomenon seems to demonstrate that the columns of humid air which rise in the northern equatorial zone, sometimes flow off toward the south pole. In fact, the countries situated in the torrid zone, both north and south of the equator, furnish, during their summer, while the sun is passing through their zenith, the maximum of difference of temperature with the air of the opposite pole. The southern temperate zone has its winter, while it rains on the north of the equator; and while a mean heat prevails from $5^{\circ}$ to $6^{\circ}$ greater than in the time of drought, when the sun is lower.* The continuation of the rains, while the bendavales blow, proves that the currents from the remoter pole do not act in the northern equinoctial zone like the currents of the nearer pole, on account of the greater humidity of the southern polar current. The air, wafted by this current, comes from a hemisphere consisting almost entirely of water. It traverses all the southern equatorial zone to reach the parallel of $8^{\circ}$ north latitude; and is consequently less dry, less cold, less adapted to act as a counter-current to renew the equinoctial air and prevent its saturation, than the northern polar current, or the breeze from the north-east. $\dagger$ We may suppose that the bendavales are impetuous winds which, on some coasts, for instance on that of Guatimala, (because they are not the effect of a regular and progressive descent of the air of the tropics towards the south pole, but they alternate with calms), are accompanied by electrical explosions, and are in fact squalls,

* From the equator to $10^{\circ}$ of north lat. the mean temperatures of the summer and winter months scarcely differ $2^{\circ}$ or $3^{\circ}$; but at the limits of the torrid zone, toward the tropic of Cancer, the difference amounts to $8^{\circ}$ or $9^{\circ}$.
+ In the two temperate zones the air loses its transparency every time that the wind blows from the opposite pole, that is to say, from the pole that has not the same denomination as the hemisphere in which the wind blows.
that indicate a reflux, an abrupt and instantaneous rupture, of equilibrium in the aërial ocean.

We have here discussed one of the most important phenomena of the meteorology of the tropics, considered in its most general view. In the same manner as the limits of the trade-winds do not form circles parallel with the equator, the action of the polar currents is variously felt in different meridians. The chains of mountains and the coasts in the same hemisphere have often opposite seasons. There are several examples of these anomalies; but, in order to discover the laws of nature, we must know, before we examine into the causes of local perturbations, the average state of the atmosphere, and the constant type of its variations.

The aspect of the sky, the progress of the electricity, and the shower of the 28th of March, announced the commencement of the rainy season; we were still advised, however, to go from San Fernando de Apure by San Francisco de Capanaparo, the Rio Sinaruco, and the Hato de San Antonio, to the village of the Ottomacs, recently founded near the banks of the Meta, and to embark on the Orinoco a little above Carichana. This way by land lies across an unhealthy and feverish country. An old farmer named Francisco Sanchez obligingly offered to conduct us. His dress denoted the great simplicity of manners prevailing in those distant countries. He had acquired a fortune of more than 100,000 piastres, and yet he mounted on horseback with his feet bare, and wearing large silver spurs. We knew by the experience of several weeks the dull uniformity of the vegetation of the Llanos, and preferred the longer road, which leads by the Rio Apure to the Orinoco. We chose one of those very large canoes called lanchas by the Spaniards. A pilot and four Indians were sufficient to manage it. They constructed, near the stern, in the space of a few hours, a cabin covered with palm-leaves, sufficiently spacious to contain a table and benches. These were made of ox-hides, strained tight, and nailed to frames of brazil-wood. I mention these minute circumstances, to prove that our accommodations on the Rio Apure were far different from those to which we were afterwards reduced in the narrow boats of the Orinoco. We loaded the canoe with provision for a month. Fowls, eggs, plantains, cassava, and cacao, are found in abundance
at San Fernando. ' The good Capuchin, Fray Jose Maria de Malaga, gave us sherry wine, oranges, and tamarinds, to make cooling beverages. We could easily foresee that a roof constructed of palm-tree leaves would becume excessively hot on a large river, where we were almost always exposed to the perpendicular rays of the sun. The Indians relied less on the provision we had purchased, than on their hooks and nets. We took also some fire-arms, which we found in general use as far as the cataracts; but farther south the great humidity of the air prevents the missionaries from using them. The Rio Apure abounds in fish, manatis, and turtles, the eggs of which afford an aliment more nutritious than agreeable to the taste. Its banks are inhabited by an innumerable quantity of birds, among which the pauxi and the guacharaca, which may be called the turkeys and pheasants of those countries, are found to be the most useful. Their flesh appeared to be harder and less white than that of the gallinaceous tribe in Eurape, because they use much more muscular exercise. We did not forget to add to our provision, fishing-tackle, fire-arms, and a few casks of brandy, to serve as a medium of barter with the Indians of the Orinoco.

We departed from San Fernando on the 30th of March, at four in the afternoon. The weather was extremely hot; the thermometer rising in the shade to $34^{\circ}$, though the breeze blew very strongly from the south-east. Owing to this contrary wind we could not set our sails. We were accompanied, in the whole of this voyage on the Apure, the Orinoco, and the Rio Negro, by the brother-in-law of the governor of the province of Varinas, Don Nicolas Soto, who had recently arrived from Cadiz. Desirous of visiting countries so calculated to excite the curiosity of a European, he did not hesitate to confine himself with us during seventy-four days in a narrow boat infested with mosquitos. His amiable disposition and gay temper often helped to make us forget the sufferings of a voyage which was not wholly exempt from danger. We passed the mouth of the Apurito, and coasted the island of the same name, formed by the Apure and the Guarico. This island is in fact only a very low spot of ground, bordered by two great rivers, both of which, at a little distance from each other, fall into
the Orinoco, after having formed a junction below San Fernando by the first bifurcation of the Apure. The Isla del Apurito is twenty-two leagues in length, and two or three leagues in breadth. It is divided by the Caño de la Tigrera and the Caño del Manati into three parts, the two extremes of which bear the names of Isla de Blanco and Isla de los Garzitas. The right bank of the Apure, below the Apurito, is somewhat better cultivated than the left bank, where the Yaruros, or Japuin Indians, hare constructed a few huts with reeds and stalks of palm-leaves. These people, who live by hunting and fishing, are very skilful in killing jaguars. It is they who principally carry the skins, known in Europe by the name of tiger-skins, to the Spanish villages. Some of these Indians have been baptized, but they never visit the Christian churches. They are considered as savages because they choose to remain independent. Other tribes of Yaruros live under the rule of the missionaries, in the village of Achaguas, situated south of the Rio Payara. The individuals of this nation, whom I had an opportunity of seeing at the Orinoco, have a stern expression of countenance ; and some features in their physiognomy, erroneously called Tartarian, belong to branches of the Mongol race, the eye very long, the cheekbones high, but the nose prominent throughout its whole length. They are taller, browner, and less thick-set than the Chayma Indians. The missionaries praise the intellectual character of the Yaruros, who were formerly a powerful and numerous nation on the banks of the Orinoco, especially in the environs of Cuycara, below the mouth of the Guarico. We passed the night at Diamante, a small sugar-plantation formed opposite the island of the same name.

During the whole of my voyage from San Fernando to San Carlos del Rio Negro, and thence to the town of Angostura, I noted down day by day, either in the boat or where we disembarked at night, all that appeared to me worthy of observation. Violent rains, and the prodigious quantity of mosquitos with which the air is filled on the banks of the Orinoco and the Cassiquiare, necessarily occasioned some interruptions; but I supplied the omission by notes taken a few days after. I here subjoin some extracts from my journal. Whatever is written while the objects we
describe are before our eyes bears a character of truth and individuality which gives attraction to things the least important.

On the ${ }^{\circ}$ 31st March a contrary wind obliged us to remain on shore till noon. We saw a part of some cane-fields laid waste by the effect of a conflagration which had spread from a neighbouring forest. The wandering Indians everywhere set fire to the forest where they have encamped at night; and during the season of drought, vast provinces would be the prey of these conflagrations if the extreme hardness of the wood did not prevent the trees from being entirely consumed. We found trunks of desmanthus and mahogany which were scarcely charred two inches deep.

Having passed the Diamante we entered a land inhabited only by tigers, crocodiles, and chiguires; the latter are a large species of the genus Cavia of Linnæus. We saw flocks of birds, crowded so closely together as to appear against the sky like a dark cloud which every instant changed its form. The river widens by degrees. One of its banks is generally barren and sandy from the effect of inundations; the other is higher, and covered with lofty trees. In some parts the river is bordered by forests on each side, and forms a straight canal a hundred and fifty toises broad. The manner in which the trees are disposed is very remarkable. We first find bushes of sauso,* forming a kind of hedge four feet high, and appearing as if they had been clipped by the hand of man. A copse of cedar, brazilletto, and lignum-vitæ, rises behind this hedge. Palm-trees are rare; we saw only a few scattered trunks of the thorny piritu and corozo. The large quadrupeds of those regions, the jaguars, tapirs, and peccaries, have made openings in the hedge of sauso which we have just described. Through these the wild animals pass when they come to drink at the river. As they fear but little the approach of a boat, we had the pleasure of viewing them as they paced slowly along the shore till they disappeared in the forest, which they entered by one of the narrow passes left at intervals between the bushes. These scenes, which were often repeated, had ever for me a peculiar attraction. The pleasure

* Hermesia castaneifolia. This is a new genus, approaching the alchornea of Swartz.
they excite is not owing solely to the interest which the naturalist takes in the objects of his study, it is connected with a feeling common to all men who have been brought up in the habits of civilization. You find yourself in a new world, in the midst of untamed and savage nature. Now the jaguar,-the beautiful panther of America,-appears upon the shore; and now the hocco," with its black plumage and tufted head, moves slowly along the sausos. Animals of the most different classes succeed each other. "Es: como en el Paraiiso," "It is just as it was in Paradise," said our pilot, an old Indian of the Missions. Everything, indeed, in these regions recalls to mind the state of the primitive world with its innocence and felicity. But in carefully observing the manners of animals among themselves, we see that they mutually avoid and fear each other. The golden age has ceased; and in this Paradise of the American forests, as well as everywhere else, sad and long experience has taught all beings that benignity is seldom found in alliance with strength.

When the shore is of considerable breadth, the hedge of sauso remains at a distance from the river. In the intermediate space we see crocodiles, sometimes to the number of eight or ten, stretched on the sand. Motionless, with their jaws wide open, they repose by each other, without displaying any of those marks of affection observed in other animals living in society. The troop separates as soon as they quit the shore. It is, however, probably composed of one male only, and many females; for as M. Descourtils, who has so much studied the crocodiles of St. Domingo, observed to me, the males are rare, because they kill one another in fighting during the season of their loves. These monstrous creatures are so numerous, that throughout the whole course of the river we had almost at every instant five or six in view. Yet at this period the swelling of the Rio Apure was scarcely perceived; and cọnsequently hundreds of crocodiles were still buried in the mud of the savannahs. About four in the afternoon we stopped to measure a dead crocodile which had been cast ashore. It was only sixteen feet eight inches long; some days after M. Bonpland found another, a male, twenty-two feet three inches long. In

[^234]every zone, in America as in Egypt, this animal attains the same size. The species so abundant in the Apure, the Orinoco,* and the Rio de la Magdalena, is not a cayman, but a real crocodile, analagous to that of the Nile, having feet dentated at the external edges. When it is recollected that the male enters the age of puberty only at ten years, and that its length is then eight feet, we may presume that the crocodile measured by M. Bonpland was at least twentyeight years old. The Indians told us, that at San Fernando scarcely a year passes, without two or three grown-up persons, particularly women who fetch water from the river, being drowned by these carnivorous reptiles. They related to us the history of a young girl of Uritucu, who by singular intrepidity and presence of mind, saved herself from the jaws of a crocodile. When she felt herself seized, she sought the eyes of the animal, and plunged her fingers into them with such violence, that the pain forced the crocodile to let her go, after having bitten off the lower part of her left arm. The girl, notwithstanding the enormous quantity of blood she lost, reached the shore, swimming with the hand that still remained to her. In those desert countries, where man is ever wrestling with nature, discourse daily turns on the best means that may be employed to escape from a tiger, a boa, or a crocodile; every one prepares himself in some sort for the dangers that may await him. "I knew," said the young girl of Uritucu coolly, "that the cayman lets go his hold, if you push your fingers into his eyes." Long after my return to Europe, I learned that in the interior of Africa the negroes know and practise the same means of defence. Who does not recollect, with lively interest, Isaac, the guide of the unfortunate Mungo Park, who was seized twice by a crocodile, and twice escaped from the jaws of the monster, having succeeded in thrusting his fingers into the creature's eyes while under water. The African Isaac, and the young American girl, owed their safety to the same presence of mind, and the same combination of ideas.

The movements of the crocodile of the Apure are sudden and rapid when it attacks any object; but it moves with the slowness of a salamander, when not excited by rage

- It is the arua of the Tamanac Indians, the amana of the Maypure Indians, the Crocodilus acutus of Cuvier.
or hunger. The animal in running makes a rustling noise, which seems to proceed from the rubbing of the scales of its skin one against another. In this movement it bends its back, and appears higher on its legs than when at rest. We often heard this rattling of the scales very near us on the shore ; but it is not true, as the Indians pretend, that, like the armadillo, the old crocodiles "can erect their scales, and every part of their armour." The motion of these animals is no doubt generally in a straight line, or rather like that of an arrow, supposing it to change its direction at certain distances. However, notwithstanding the little apparatus of false ribs, which connects the vertebre of the neck, and seems to impede the lateral movement, crocodiles can turn easily when they please. I often saw young ones biting their tails; and other observers have seen the same action in crocodiles at their full growth. If their movements almost always appear to be straight forward, it is because, like our small lizards, they move by starts. Crocodiles are excellent swimmers; they go with facility against the most rapid current. It appeared to me, however, that in descending the river, they had some difficulty in turning quickly about. A large dog, which had accompanied us in our journey from Caracas to the Rio Negro, was one day pursued in swimming by an enormous crocodile. The latter had nearly reached its prey, when the dog escaped by turning round suddenly and swimming against the current. The crocodile performed the same movement, but much more slowly than the dog, which succeeded in gaining the shore.
The crocodiles of the Apure find abundant food in the chiguires (thick-nosed tapirs),* which live fifty or sixty together in troops on the banks of the river. These animals, as large as our pigs, have no weapons of defence; they swim somewhat better than they run: yet, they become the prey
* Cavia capybara, Linn. The word chiguire belongs to the language of the Palenkas and the Cumanagotos. The Spaniards call this animal guardatinaja; the Caribs, capigua; the Tamanacs, cappiva; and the Maypures, chiato. According to Azara, it is known at Buenos Ayres by the Indian names of capiygua and capiguara. These various denominations show a striking analogy between the languages of the Orinoco and those of the Rio de la Plata,
of the crocodiles in the water, and of the tigers on land. It is difficult to conceive, how, being thus persecuted by two powerful enemies, they become so numerous; but they breed with the same rapidity as the little cavies or guineapigs, which come to us from Brazil.

We stopped below the mouth of the Caño de la Tigrera, in a sinuosity called la Vuelta del Joval, to measure the velocity of the water at its surface. It was not more than 3.2 feet: in a second, which gives 2.56 feet for the mean velocity. The height of the barometer indicated barely a slope of seventeen inches in a mile of nine hundred and fifty toises. The velocity is the simultaneous effect of the slope of the ground, and the accumulation of the waters by the swelling of the upper parts of the river. We were again surrounded by chiguires, which swim like dogs, raising their heads and necks above the water. We saw. with surprise a large crocodile on the opposite shore, motionless, and sleeping in the midst of these nibbling animals. It awoke at the approach of our canoe, and went into the water slowly, without frightening the chiguires. Our Indians accounted for this indifference by the stupidity of the animals, but it is more probable that the chiguires know by long experience, that the crocodile of the Apure and the Orinoco does not attack upon land, unless he finds the object he would seize immediately in his way, at the instant when he throws himself into the water.

Near the Joval nature assumes an awful and extremely wild aspect. We there saw the largest jaguar we had ever met with. The natives themselves were astonished at its prodigious length, which surpassed that of any Bengal tiger I had ever seen in the museums of Europe. The animal lay stretched beneath the shade of a large zamang.* It had just killed a chiguire, but had not yet touched its prey, on which it kept one of its paws. The zamuro vultures were assembled in great numbers to devnur the remains of the jaguar's repast. They presented the most curious spectacle,

[^235]by a singular mixture of boldness and timidity. They advanced within the distance of two feet from the animal, but at the least movement he made they drew back. In order to observe more nearly the manners of these creatures, we went into the little skiff that accompanied our canoe. Tigers very rarely attack boats by swimming to them; and never but when their ferocity is heightened by a long privation of food. The noise of our oars led the animal to rise slowly, and hide itself behind the sauso bushes that bordered the shore. The vultures tried to profit by this moment of absence to devour the chiguire; but the tiger, notwithstanding the proximity of our boat, leaped into the midst of them, and in a fit of rage, expressed by his gait and the movement of his tail, carried off his prey to the forest. The Indians regretted that they were not provided with their lances, in order to go on shore and attack the tiger. They are accustomed to this weapon, and were right in not trusting to our fire-arms. In so excessively damp an atmosphere muskets often miss fire.

Continuing to descend the river, we met with the great herd of chiguires which the tiger had put to flight, and from which he had selected his prey. These animals saw us land very unconcernedly; some of them were seated, and gazed upon us, moving the upper lip like rabbits. They seemed not to be afraid of man, but the sight of our dog put them to flight. Their hind legs being longer than their fore legs, their pace is a slight gallop, but with so little swiftness that we succeeded in catching two of them. The chiguire, which swims with the greatest agility, utters a short moan in running, as if its respiration were impeded. It is the largest of the family of rodentia or gnawing animals. It defends itself only at the last extremity, when it is surrounded and wounded. Having great strength in its grinding teeth,* particularly the hinder ones, which are pretty long, it can tear the paw of a tiger, or the leg of a horse, with its bite.

[^236]Its flesh has a musky smell somewhat disagreeable; yet hams are made of it in this country, a circumstance which almost justifies the name of 'water-hog,' given to the chiguire by some of the older uaturalists. The missionary monks do not hesitate to eat these hams during Lent. According to their zoological classification they place the armadillo, the thick-nosed taper, and the manati, near the tortoises; the first, because it is covered with a hard armour like a sort of shell; and the others because they are amphibious. The chiguires are found in such numbers.on the banks of the rivers Santo Domingo, Apure, and Arauca, in the marshes and in the inundated savannahs* of the Llanos, that the pasturages suffer from them. They browze the grass which fattens the horses best, and which bears the name of chiguirero, or chiguire-grass. They feed also upon fish; and we saw with surprise, that, when scared by the approach of a boat, the animal in diving remains eight or ten minutes under water.

We passed the night as usual, in the open air, though in a plantation, the proprietor of which employed himself in hunting tigers. He wore scarcely any clothing, and was of a dark brown complexion like a Zambo. This did not prevent his classing himself amongst the Whites. He called his wife and his daughter, who were as naked as himself, Doña Isabella and Doña Manuela. Without having ever quitted the banks of the Apure, he took a lively interest in the news of Madrid,-enquiring eagerly respecting "those never-ending wars, and everything down yonder (todas las cosas de alla)." He knew, he said, that the king was soon to come and visit "the grandees of the country of Caracas," but he added with some pleasantry, "as the people of the court can eat only wheaten bread, they will never pass beyond the town of Victoria, and we shall not see them here." I had brought with me a chiguire, which I had intended to have roasted; but our host assured us, that such 'Indian game' was not food fit for "nos otros caballeros blancos," (white gentlemen like ourselves and him). Accordingly he offered us some venison, which he had killed the day before with an arrow, for he had neither powder nor fire-arms.

[^237]We supposed that a small wood of plantain-trees concealed from us the hut of the farm; but this man, so proud of his nobility and the colour of his skin, had not taken the trouble of constructing even an ajoupa, or hut of palmleaves. He invited us to have our hammocks hung near his own, between two trees; and he assured us, with an air of complacency, that, if we came up the river in, the rainy season, we should find him beneath a roof (baxo techo). We soon had reason to complain of a system of philosophy which is indulgent to indolence, and renders a man indifferent to the conveniences of life. A furious wind arose after midnight, lightnings flashed over the horizon, thunder rolled, and we were wet to the skin. During this storm a whimsical incident served to amuse us for a moment. Doña Isabella's cat had perched upon the tamarind-tree, at the foot of which we lay. It fell into the hammock of one of our companions, who, being hart by the claws of the cat, and suddenly aroused from a profound sleep, imagined he was attacked by some wild beast of the forest. We ran to him on hearing his cries, and had some trouble to convince him of his error. While it rained in torrents on our hammocks and on our instruments which we had brought ashore, Don Ignacio congratulated us on our good fortune in not sleeping on the strand, but finding ourselves in his domain, among whites and persons of respectability (entre gente blanca y de trato). Wet as we were, we could not easily persuade ourselves of the advantages of our situation, and we listened with some impatience to the long narrative our host gave us of his pretended expedition to the Rio Meta, of the valour he had displayed in a sanguinary combat with the Guahibo Indians, and "the services that he had rendered to God and his king, in carrying away Indian children (los Indiecitos) from their parents, to distribute them in the Missions." We were struck with the singularity of finding in that vast solitude a man believing himself to be of European race and knowing no other shelter thau the shade of a tree, and yet having all the vain pretensions, hereditary prejudices, and errors of long-standing civilization!

On the 1st of April, at sunrise, we quitted Señor Don Ignacio and Señora Doña Isabella his wife. The weather
was cooler, for the thermometer (which generally kept up in the daytime to $30^{\circ}$ or $35^{\circ}$ ) had sunk to $24^{\circ}$. The temperature of the river was little changed: it continued.constantly at $26^{\circ}$ or $27^{\circ}$. The current carried with it an enornous number of trunks of trees. It might be imagined that on ground entirely smooth, and where the eye cannot distinguish the least hill, the river would have formed by the force of its current a channel in a straight line; but a glance at the map, which I traced by the compass, will prove the contrary. The two banks, worn by the waters, do not furnish an equal resistance; and almost imperceprible inequalities of the level suffice to produce great sinuosities. Yet below the Joval, where the bed of the river enlarges a little, it forms a channel that appears perfectly straight, and is shaded on each side by very tall trees. This part of the river is called Caño Rico. I found it to be one hundred and thirty-six toises broad. We passed a low island, inhabited by thousands of flamingos, rosecoloured spoonbills, herons, and moorhens, which displayed plumage of the most various colours. These birds were so close together that they seemed to be unable to stir. The island they frequent is called Isla de Aves, or Bird Island. Lower down we passed the point where the Rio Arichuna, an arm of the Apure, branches off to the Cabulare, carrying away a considerable body of its waters. We stopped, on the right bank, at a little Indian mission, inhabited by the tribe of the Guamos, called the village of Santa Barbara de Arichuna.

The Guamos* are a race of Indians very difficult to fix on a settled spot. They have great similarity of manners with the Achaguas, the Guajibos, $\dagger$ and the Ottomacs, partaking their disregard of cleanliness, their spirit of vengeance, and their taste for wandering; but their language differs essentially. The greater part of these four tribes live by fishing and hunting, in plains often inundated, situated between the Apure, the Meta, and the Guaviare. The nature of these regions seems to invite the natives to a wandering life. On entering the mountains of the Cata-

[^238]racts of the Orinoco, we shall soon find, among the Piraoss, the Macos, and the Maquiritaras, milder manners, a love of agriculture, and great cleanliness in the interior of their huts. On mountain ridges, in the midst of impenetrable forests, man is compelled to fix himself, and cultivate a small spot of land. This cultivation requires little care; while, in a country where there are no other roads than rivers, the life of the hunter is laborious and difficult. The Guamos of the mission of Santa Barbara could not furnish us with the provision we wanted. They cultivate only a little cassava. They appeared hospitable; and when we entered their huts, they offered us dried fish, and water cooled in porous vessels.

Beyond the Vuelta del Cochino Roto, in a spot where the river has scooped itself a new bed, we passed the night on a bare and very extensive strand. The forest being impenetrable, we had the greatest difficulty to find dry wood to light fires, near which the Indians believe themselves in safety from the nocturnal attacks of the tiger. Our own experience seems to bear testimony in favour of this opinion; but Azara asserts that, in his time, a tiger in Paraguay carried off a man who was seated near a fire lighted in tho savannah.

The night was calm and serene, and there was a beautiful moonlight. The crocodiles, stretched along the shore, placed themselves in such a manner as to be able to see the fire. We thought we observed that its blaze attracted them, as it attracts fishes, crayfish, and other inhabitants of the water. The Indians showed us the tracks of three tigers in the sand, two of which were very young. A female had no doubt conducted her little ones to drink at the river. Finding no tree on the strand, we stuck our oars in the ground, and to these we fastened our hammocks. Everything passed tranquilly till eleven at night; and then a noise so terrific arose in the neighbouring forest, that it was almost impossible to close our eyes. Amid the cries of so many wild beasts howling at once, the Indians discriminated such only as were at intervals heard separately. These were the little soft cries of the sapajous, the moans of the alouate apes, the howlings of the jaguar and couguar, the peccary, and the sloth, and the cries of the curassao, the
parraka, and other gallinaceous birds. When the jaguars approached the skirt of the forest, our dog, which till then had never ceased barking, began to howl and seek for shelter beneath our hammocks. Sometimes, after a long silence, the cry of the tiger came from the tops of the trees; and then it was followed by the sharp and long whistling of the monkeys, which appeared to flee from the danger that threatened them. We heard the same noises repeated, during the course of whole months, whenever the forest approached the bed of the river. The security evinced by the Indians inspires confidence in the minds of travellers, who readily persuade themselves that the tigers are afraid of fire, and that they do not attack a man lying in his hammock. These attacks are in fact extrenely rare; and, during a long abode in South America, I remember only one example, of a llanero, who was found mutilated in his hammock opposite the island of Achaguas.

When the natives are interrogated on the causes of the tremendous noise made by the beasts of the forest at certain hours of the night, the answer is, "They are keeping the feast of the full moon."

I believe this agitation is most frequently the effect of some conflict that has arisen in the depths of the forest. The jaguars, for instance, pursue the peccaries and the tapirs, which, having no defence but in their numbers, flee in close troops, and break down the bushes they find in their way. Terrified at this struggle, the timid and mistrustful monkies answer, from the tops of the trees, the cries of the large animals. They awaken the birds that live in society, and by degrees the whole assembly is in commotion. It is not always in a fine moonlight, but more particularly at the time of a storm and violent showers, that this tumult takes place among the wild beasts. "May Heaven grant them a quiet night and repose, and us also!" said the monk who accompanied us to the Rio Negro, when, sinking with fatigue, he assisted in arranging our accommodations for the night. It was indeed strange, to find no silence in the solitude of woods. In the inns of Spain we dread the sound of guitars from the next apartment; on the Orinoco, where the traveller's resting-place is the open beach, or beneath
the shelter of a solitary tree, his slumbers are disturbed by a serenade from the forest.

We set sail before sunrise, on the 2nd of April. The morning was beautiful and cool, according to the feelings of those who are accustomed to the heat of these climates. The thermometer rose only to $28^{\circ}$ in the air, but the dry and white sand of the beach, notwithstanding its radiation towards a cloudless sky, retained a temperature of $36^{\circ}$. The porpoises (toninas) ploughed the river in long files. The shore was covered with fishing-birds. Some of these perched on the floating wood as it passed down the river, and surprised the fish that preferred the middle of the stream. Our canoe was aground several times during the morning. These shocks are sufficiently violent to split a light bark. We struck on the points of several large trees, which remain for years in an oblique position, sunk in the mud. These trees descend from Sarare, at the period of great inundations, and they so fill the bed of the river, that canoes in going up find it difficult sometimes to make their way over the shoals, or wherever there are eddies. We reached a spot near the island of Carizales, where we saw trunks of the locust-treo, of an enormous size, above the surface of the water. They were covered with a species of plotus, nearly resembling the anhinga, or white bellied darter. These birds perch in files, like pheasants and parrakas, and they remain for hours entirely motionless, with their beaks raised toward the sky.

Bolow the island of Carizales we observed a diminution of the waters of the river, at which we were the more surprised, an, after tho bifurcation at la Boca de Arichuna, there in no brunch, no natural drain, which takes away water from the A pure. The loss is solely the effect of evaporation, and of flltrution on a sandy and wet shore. Some idea of the magnitude of these effects may be formed, from the fact that wo found the heat of the dry sands, at different hours of the day, from $86^{\circ}$ to $52^{\circ}$, and that of sands covered with thrse or four inches of water $32^{\circ}$. The beds of rivers are heated an far as the depth to which the solar rays can panptrato without undergoing too great an extinction in their pawaage through the superincumbent strata of water.

Besides, filtration extends in a lateral direction far beyond the bed of the river. The shore, which apears dry to us, imbibes water as far up as to the level of the surface of the river. We saw water gush out at the distance of fifty toises from the shore, every time that the Indians struck their oars into the ground. Now these sands, wet below, but dry above, and exposed to the solar rays, act like sponges, and lose the infiltrated water every instant by evaporation. The vapour that is emitted, traverses the upper stratum of sand strongly heated, and becomes sensible to the eye when the air cools towards evening. As the beach dries, it draws from the river new portions of water; and it may be easily conceived that this continual alternation of vaporization and lateral absorption must cause an immense loss, difficult to submit to exact calculation. The increase of these losses would be in proportion to the length of the course of the rivers, if from their source to their mouth they were equally surrounded by a flat shore; but these shores being formed by deposits from the water, and the water having less velocity in proportion as it is more remote from its source, throwing down more sediment in the lower than in the upper part of its course, many rivers in hot climates undergo a diminution in the quantity of their water, as they approach their outlets. Mr. Barrow observed these curious effects of sands in the southern part of Africa, on the banks of the Orange River. They have also become the subject of a very important discussion, in the various hypotheses that have been formed respecting the course of the Niger.*

Near the Vuelta de Basilio, where we landed to collect plants, we saw on the top of a tree two beautiful little monkeys, black as jet, of the size of the $s a i$, with prehensile tails. Their physiognomy and their movements sufficiently showed that they were neither the quato (Simia beelzebub)

[^239]nor the chamek, nor any of the Ateles. Our Indians themselves had never seen any that resembled them. Monkeys, especially those living in troops, make long emigrations at certain periods, and consequently it happens that at the beginning of the rainy seasons the natives discover round their huts different kinds which they have not before observed. On this same bank our guides showed us a nest of young iguanas only four inches long. It was difficult to distinguish them from common lizards. There was no distinguishing mark yet formed but the dewlap below the throat. The dorsal spines, the large erect scales, all those appendages that render the iguana so remarkable when it attains its full growth, were scarcely traceable.

The flesh of this animal of the saurian family appeared to us to have an agreeable taste in every country where the climate is very dry; we even found it so at periods when we were not in want of other food. It is extremely white, and next to the flesh of the armadillo, one of the best kinds of food to be found in the huts of the natives.

It rained toward evening, and before the rain fell, swallows, exactly resembling our own, skimmed over the surface of the water. We saw also a flock of paroquets pursued by little goshawks without crests. The piercing cries of these paroquets contrasted singularly with the whistling of the birds of prey. We passed the night in the open air, upon the beach, near the island of Carizales. There were several Indian huts in the neighbourhood, surrounded with plantations. Our pilot assured us beforehand that we should not hear the cries of the jaguar, which, when not extremely pressed by hunger, withdraws from places where he does not reign unmolested. "Men put him out of humour" (los hombres lo enfadan), say the people in the Missions. A pleasant and simple expression, that marks a well-observed fact.

Since our departure from San Fernando we had not met a single boat on this fine river. Everything denoted the most profound solitude. On the morning of the 3rd of April our Indians caught with a hook the fish known in the country by the name of caribe,* or caribito, because no other fish has such a thirst for blood. It attacks bathers and

* Caribe in the Spanish language signifies cannibal.
swimmers, from whom it often bites away considerable pieces of flesh. The Indians dread extremely these caribes; and several of them showed us the scars of deep wounds in the calf of the leg and in the thigh, made by these little animals. They swim at the bottom of rivers; but if a few drops of blood be shed on the water, they rise by thousands to the surface, so that if a person be only slightly bitten, it is difficalt for him to get out of the water without receiving a severer wound. When we reflect on the numbers of these fish, the largest and most voracious of which are only four or five inches long, on the triangular form of their sharp and cutting teeth, and on the amplitude of their retractile mouths, we need not be surprised at the fear which the caribe excites in the inhabitants of the banks of the Apure and the Orinoco. In places where the river was very limpid, where not a fish appeared, we threw into the water little morsels of raw flesh, and in a few minutes a perfect cloud of caribes had come to dispute their prey. The belly of this fish has a cutting edge, indented like a saw, a characteristic which may be also traced in the serra-salmes, the myletes, and the pristigastres. The presence of a second adipous dorsal fin, and the form of the teeth, covered by lips distant from each other, and largest in the lower jaw, place the caribe among the serra-salmes. Its mouth is much wider than that of the myletes of Cuvier. Its body, toward the back, is ash-coloured with a tint of green, but the belly, the gill-covers, and the pectoral, anal, and ventral fins, are of a fine orange hue. Three species are known in the Orinoco, and are distinguished by their size. The intermediate appears to be identical with the medium species of the piraya, or piranha, of Marcgrav.* The caribito has a very agreeable flavour. As no one dares to bathe where it is found, it may be considered as one of the greatest scourges of those climates, in which the sting of the mosquitos and the general irritation of the skin render the use of baths so necessary.

We stopped at noon in a desert spot called Algodonal. I left my companions while they drew the boat ashore and were occupied in preparing our dinner. I went along the beach to get a near view of a group of crocodiles sleeping in

[^240]the sun, and lying in such a manner as to have their tails, which were furnished with broad plates, resting on one another. Some little herons,* white as snow, walked along their backs, and even upon their heads, as if passing over trunks of trees. The crocodiles were of a greenish grey, half covered with dried mud; from their colour and immobility they might have been taken for statues of bronze. This excursion had nearly proved fatal to me. I had kept my eyes constantly turned towards the river; but, whilst picking up some spangles of mica agglomerated together in the sand, I discovered the recent footsteps of a tiger, easily distinguishable from their form and size. The animal had gone towards the forest, and turning my eyes on that side, I found myself within eighty paces of a jaguar that was lying under the thick foliage of a ceiba. No tiger had ever appeared to me so large.

There are accidents in life against which we may seek in vain to fortify our reason. I was extremely alarmed, yet sufficiently master of myself and of my motions to enable me to follow the advice which the Indians had so often given us as to how we ought to act in such cases. I continued to walk on without running, avoided moving my arms, and I thought I observed that the jaguar's attention was fixed on a herd of capybaras which was crossing the river. I then began to return, making a large circuit toward the edge of the water. As the distance increased, I thought I might accelerate my pace. How often was I tempted to look back in order to assure myself that I was not pursued! Happily I yielded very tardily to this desire. The jaguar had remained motionless. These enormous cats with spotted robes are so well fed in countries abounding in capybaras, pecaries, and deer, that they rarely attack men. I arrived at the boat out of breath, and related my adventure to the Indians. They appeared very little interested by my story; yet, after having loaded our guns, they accompanied us to the ceiba

[^241]beneath which the jaguar had lain. He was there no longer, and it would have been imprudent to have pursued him into the forest, where we must have dispersed, or advanced in single file, amidst the intertwining lianas.

In the evening we passed the mouth of the Caño del Manati, thus named on account of the immense quantity of manatis caught there every year. This herbivorous animal of the cetaceous family, is called by the Indians apcia and avia,* and it attains here generally ten or twelve feet in length. It usually weighs from five hundred to eight hundred pounds, but it is asserted that one has been taken of eight thousand pounds weight. The manati abounds in the Orinoco below the cataracts, in the Rio Meta, and in the Apure, between the two islands of Carizales and Conserva. We found no vestiges of nails on the external surface or the edges of the fins, which are quite smooth; but little rudiments of nails appear at the third phalanx, when the skin of the fins is taken off. We dissected one of these animals, which was nine feet long, at Carichana, a Mission of the Orinoco. The upper lip was four inches longer than the lower one. It was covered with a very fine skin, and served as a proboscis. The inside of the mouth, which has a sensible warmth in an animal newly killed, presented a very singular conformation. The tongue was almost motionless; but in front of the tongue there was a fleshy excrescence in each jaw, and a cavity lined with a very hard skin, into which the excrescence fitted. The manati eats such quantities of grass, that we have found its stomach, which is divided into several cavities, and its intestines, (one hundred and eight feet long, filled with it. On opening the animal at the back, we were struck with the magnitude, form, and situation of its lungs. They have very large cells, and resemble immense swimming-bladders. They are three feet long. Filled with air, they have a bulk of more than a thousand cubic inches. I was surprised to see that, possessing such

[^242]considerable receptacles for air, the manati comes so often to the surface of the water to breathe. Its flesh is very savoury, though, from what prejudice I know not, it is considered unwholesome and apt to produce fever. It appeared to me to resemble pork rather than beef. It is most esteemed by the Guamos and the Ottomacs ; and these two nations are particularly expert in catching the manati. Its flesh, when salted and dried in the sun, can be preserved a whole year; and, as the clergy regard this mammiferous animal as a fish, it is much sought during Lent. The vital principal is singularly strong in the manati; it is tied after being harpooned, but is not killed till it has been taken into the canoe. This is effected, when the animal is very large, in the middle of the river, by filling the canoe two-thirds with water, sliding it under the animal, and then baling out the water by means of a calabash. This fishery is most easy after great inundations, when the manati has passed from the great rivers into the lakes and surrounding marshes, and the waters diminish rapidly. At the period when the Jesuits governed the Missions of the Lower Orinoco, they assembled every year at Cabruta, below the mouth of the Apure, to have a grand fishing for manatis, with the Indians of their Missions, at the foot of the mountain now called El Capuchino. The fat of the animal, known by the name of manati-butter (manteca de manati,) is used for lamps in the churches; and is also employed in preparing food. It has not the fetid smell of whale-oil, or that of the other cetaceous animals which spout water. The hide of the manati, which is more than an inch and half thick, is cut into slips, and serves, like thongs of ox-leather, to supply the place of cordage in the Llanos. When immersed in water, it has the defect of undergoing a slight degree of putrefaction. Whips are made of it in the Spanish colonies. Hence the words latigo and manati are synonymous. These whips of manati-leather are a cruel instrument of punishment for the unhappy slaves, and even for the Indians of the Missions, though, according to the laws, the latter ought to be treated like freemen.

We passed the night opposite the island of Conserva. In skirting the forest we were surprised by the sight of an enormous trunk of a tree seventy feet high, and thickly set with
branching thorns. It is called hy the natives barba de tigre. It was perhaps a tree of the berberideous family.* The Indians had kindled fires at the edge of the water. We again perceived, that their light attracted the crocodiles, and even the porpoises (toninas), the noise of which interrupted our sleep, till the fire was extinguished. A female jagnar approached our station whilst taking her young one to drink at the river. The Indians succeeded in chasing her away, but we heard for' a long time the cries of the little jaguar, which mewed like a young cat. Soon after, our great dog was bitten, or, as the Indians say, stung, at the point of the nose, by some enormous bats that hovered around our hammocks. These bats had long tails, like the Molosses: I believe, however, that they were Phyllostomes, the tongue of which, furnished with papill $\otimes$, is an organ of suction, and is capable of being considerably elongated. The dog's wound was very small and round; and though he uttered a plaintive cry when he felt himself bitten, it was not from pain, but because he was frightened at the sight of the bats, which came out from beneath our hammocks. These accidents are much more rare than is believed even in the country itself. In the course of several years, notwithstanding we slept so often in the open air, in climates where vampire-bats, $\dagger$ and other analagous species are so common, we were never wounded. Besides, the puncture is no-way dangerous, and in general causes so little pain, that it often does not awaken the person till after the bat has withdrawn.

The 4th of April was the last day we passed on the Rio Apure. The vegetation of its banks became more and more uniform. During several days, and particularly since we had left the Mission of Arichuna, we had suffered cruelly from the stings of insects, which covered our faces and hands. They were not mosquitos, which have the appear-

[^243]† Verspertilio spectrum.
ance of little flies, or of the genus Simulium, but zancudos; which are really gnats, though very different from our European species.* These insects appear only after sunset. Their proboscis is so long that, when they fix on the lower surface of a hammock, they pierce through it and the thickest garments with their sting.

We had intended to pass the night at the Vuelta del Palmito, but the number of jaguars at that part of the Apure is so great, that our Indians found two hidden behind the trunk of a locust-tree, at the moment when they were going to sling our hammocks. We were advised to re-embark, and take our station in the island of Apurito, near its junction with the Orinoco. That portion of the island belongs to the province of Caracas, while the right banks of the Apure and the Orinoco form a part, the one of the province of Varinas, the other of Spanish Guiana. We found no trees to which we could suspend our hammocks, and were obliged to sleep on ox-hides spread on the ground. The boats were too narrow and too full of zancudos to permit us to pass the night in them.

In the place where we had landed our instruments, the banks being steep, we saw new proofs of the indolence of the gallinaceous birds of the tropics. The curassaos and cashew-birds $\dagger$ have the habit of going down several times a-day to the river to allay their thirst. They drink a great deal, and at short intervals. A vast number of these birds had joined, near our station, a flock of parraka pheasants. They had great difficulty in climbing up the steep banks; they attempted it several times without using their wings. We drove them before us, as if we had been driving sheep. The zamuro vultures raise themselves from the ground with great reluctance.

We were singularly struck at the small quantity of water which the Rio Apure furnishes at this season to the Orinoco. The Apure, which, according to my measurements, was still one hundred and thirty-six toises broad at the Caño Rico, was only sixty or eighty at its mouth.* Its depth

[^244]here was only three or four toises. It loses, no doubt, a part of its waters by the Rio Arichuna and the Caño del Manati, two branches of the Apure that flow into the Payara and the Guarico; but its greatest loss appears to be caused by filtrations on the beach, of which we have before spoken. The velocity of the Apure near its mouth was only $3 \cdot 2$ feet per second; so that I could easily have calculated the whole quantity of the water if I had taken, by a series of proximate soundings, the whole dimensions of the tranverse section.

We touched several times on shoals before we entered the Orinoco. The ground gained from the water is immense towards the confluence of the two rivers. We were obliged to be towed along by the bank. What a contrast between this state of the river immediately before the entrance of the rainy season, when all the effects of dryness of the air and of evaporation have attained their maximum, and that autumnal state when the Apure, like an arm of the sea, covers the savannahs as far as the eye can reach! We discerned towards the south the lonely hills of Coruato; while to the east the granite rocks of Curiquima, the Sugar Loaf of Caycara, and the mountains of the Tyrant* (Cerros del Tirano) began to rise on the horizon. It was not without emotion that we beheld for the first time, after long expectation, the waters of the Orinoco, at a point so distant from the coast.

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#### Abstract

Chapter XIX. Junction of the Apure and the Orinoco.-Mountains of Encaramada.Uruana. - Baraguan.-Carichana.-Mouth of the Meta.-Island of Panumana.


On leaving the Rio Apure we found ourselves in a country presenting a totally different aspect. An immense plain of water stretched before us like a lake, as far as we could see. White-topped waves rose to the height of several feet, from the conflict of the breeze and the current. The air resounded no longer with the piercing cries of herons, flamingos, and spoonbills, crossing in long files from one shore to the other. Our eyes sought in vain those waterfowls, the habits of which vary in each tribe. All nature appeared less animated. Scarcely could we discover in the hollows of the waves a few large crocodiles, cutting obliquely, by the help of their long tails, the surface of the agitated waters. The horizon was bounded by a zone of forests, which nowhere reached so far as the bed of the river. A vast beach, constantly parched by the heat of the sun, desert and bare as the shores of the sea, resembled at a distance, from the effect of the mirage, pools of stagnant water. These sandy shores, far from fixing the limits of the river, render them uncertain, by enlarging or contracting them alternately, according to the variable action of the solar rays.

In these scattered features of the landscape, in this character of solitude and of greatness, we recognize the course of the Orinoco, one of the most majestic rivers of the New World. The water, like the land, displays everywhere a characteristic and peculiar aspect. The bed of the Orinoco resembles not the bed of the Meta, the Guaviare, the Rio Negro, or the Amazon. These differences do not depend altogether on the breadth or the velocity of the current; they are connected with a multitude of impressions which it is easier to perceive upon the spot than to define with precision. Thus, the mere form of the waves, the tint of
the waters, the aspect of the sky and the clouds, would lead an experienced navigator to guess whether he were in the Atlantic, in the Mediterranean, or in the equinoctial part of the Pacific.

The wind blew fresh from east-north-east. Its direction was favourable for sailing up the Orinoco, towards the Mission of Encaramada; but our canoes were so ill calculated to resist the shocks of the waves, that, from the violence of the motion, those who suffered habitually at sea were equally incommoded on the river. The short, broken waves are caused by the conflict of the waters at the junction of the two rivers. This conflict is very violent, but far from being so. dangerous as Father Gumilla describes. We passed the Punta Curiquima, which is an isolated mass of quartzose granite, a small promontory composed of rounded blocks. There, on the right bank of the Orinoco, Father Rotella founded, in the time of the Jesuits, a Mission of the Palenka and Viriviri or Guire Indians. But during inundations, the rock Curiquima and the village at its foot were entirely surrounded by water; and this serious inconvenience, together the sufferings of the missionaries and Indians from the innumerable quantity of mosquitos and niguas,* led them to forsake this humid spot. It is now entirely deserted, while opposite to it, on the right bank of the river, the little mountains of Coruato are the retreat of wandering Indians, expelled either from the Missions, or from tribes that are not subject to the government of the monks.

Struck with the extreme breadth of the Orinoco, between the mouth of the Apure and the rock Curiquima, I ascertained it by means of a base measured twice on the western beach. The bed of the Orinoco, at low water, was 1906 toises broad; but this breadth increases to 5517 toises, when, in the rainy season, the rock Curiquima, and the farm of Capuchino near the hill of Pocopocori, become islands. The swelling of the Orinoco is augmented by the impulse of the waters of the Apure, which, far from forming, like other rivers, an acute angle with the upper part of that into which it flows, meets it at right angles.

We first proceeded south-west, as far as the shore inhabited

- The chego (Pulex penetrans), which penetrates under the nails of the toes in men and monkeys, and there deposits its eggs.
by the Guaricoto Indians on the left bank of the Orinoco, and then we advanced straight toward the south. The river is so broad that the mountains of Encaramada appear to rise from the water, as if seen above the horizon of the sea. They form a continued chain from east to west. These mountains are composed of enormous blocks of granite, cleft and piled one upon another. Their division into blocks is the effect of decomposition. What contributes above all to embellish the scene at Encaramada is the luxuriance of vegetation that covers the sides of the rocks, leaving bare only their rounded summits. They look like ancient ruins rising in the midst of a forest. The mountain immediately at the back of the Mission, the Tepupano* of the Tamanac Indians, is terminated by three enormous granitic cylinders, two of which are inclined, while the third, though worn at its base, and more than eighty feet high, has preserved a vertical position. This rock, which calls to mind the form of the Schnarcher in the Hartz mountains, or that of the Organs of Actopan in Mexico, $\dagger$ composed formerly a part of the rounded summit of the mountain. In every climate, unstratified granite separates by decomposition into blocks of prismatic, cylindric, or columnar figures.

Opposite the shore of the Guaricotos, we drew near another heap of rocks, which is very low, and three or four toises long. It rises in the midst of the plain, and has less resemblance to a tumulus than to those masses of granitic stone, which in North Holland and Germany bear the name of hünenbette, beds (or tombs) of heroes. The shore, at this part of the Orinoco, is no longer of pure and quartzose sand; but is composed of clay and spangles of mica, deposited in very thin strata, and generally at an inclination of forty or fifty degrees. It looks like decomposed mica-slate. This change in the geological configuration of the shore extends

[^246]far beyond the mouth of the Apure. We had begun to observe it in this latter river as far off as Algodonal and the Caño del Manati. The spangles of mica come, no doubt, from the granite mountains of Curiquima and Encaramada; since further north-east we find only quartzose sand, sandstone, compact limestone, and gypsum. Alluvial earth carried successively from south to north need not surprise us in the Orinoco; but to what shall we attribute the same phenomenon in the bed of the Apure, seven leagues west of its mouth? In the present state of things, notwithstanding the swellings of the Orinoco, the waters of the Apure never retrograde so far; and, to explain this phenomenon, we are forced to admit that the micaceous strata were deposited at a time when the whole of the very low country lying between Caycara, Algodonal, and the mountains of Encaramada, formed the basin of an inland lake.
We stopped some time at the port of Encaramada, which is a sort of embarcadero, a place where boats assemble. A rock of forty or fifty feet high forms the shore. It is composed of blocks of granite, heaped one upon another, as at the Schneeberg in Franconia, and in almost all the granitic mountains of Europe. Some of these detached masses have a spheroidal form; they are not balls with concentric layers, but merely rounded blocks, nuclei separated from their envelopes by the effect of decomposition. This granite is of a greyish lead-colour, often black, as if covered with oxide of manganese; but this colour does not penetrate one fifth of a line into the rock, which is of a reddish white colour within, coarse-grained, and destitute of hornblende.

The Indian names of the Mission of San Luis del Encaramada, are Guaja and Caramana.* This small village was

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founded in 1749 by Father Gili, the Jesuit, author of the Storia dell' Orinoco, published at Rome. This missionary; learned in the Indian tongues, lived in these solitudes during eighteen years, till the expulsion of the Jesuits. To form a precise idea of the savage state of these countries it must be recollected that Father Gili speaks of Carichana,* which is forty leagues from Encaramada, as of a spot far distant; and that he never advanced so far as the first cataract in the river of which he ventured to undertake the description.

In the port of Encaramada we met with some Caribs of Panapana. A cacique was going up the Orinoco in his canoe, to join in the famous fishing of turtles' eggs. His canoe was rounded toward the bottom like a bongo, and followed by a smaller boat called a curiara. He was seated beneath a sort of tent, constructed, like the sail of palmleaves. His cold and silent gravity, the respect with which he was treated by his attendants, everything denoted him to be a person of importance. He was equipped, however, in the same manner as his Indians. They were all equally naked, armed with bows and arrows, and painted with onoto, which is the colouring fecula of the Bixa orellana. The chief, the domestics, the furniture, the boat, and the sail, were all painted red. These Caribs are men of an almost athletic stature; they appeared to us much taller than any Indians we had hitherto seen. Their smooth and thick hair, cut short on the forehead like that of choristers, their eyebrows painted black, their look at once gloomy and animated, gave a singular expression to their countenances. Having till then seen only the skulls of some Caribs of the West India Islands preserved in the collections of Europe, we were surprised to find that these Indians, who were of pure race, had foreheads much more rounded than they are described. The women, who were very tall, and disgusting are scattered in our maps as if by chance. It is pretended that the Mission of Guaja affords a very rare example of the composition of two Spanish words. The word Encaramada means things raised one upon another, from encaramar, 'to raise up.' It is derived from the figure of Tepupano and the neighbouring rocks: perhaps it is only an Indian word caramana, in which, as in manati, a Spanish signification was believed to be discovered.
*Saggio di Storia Americana, rol. i. p. 122.
from their want of cleanliness, carried their infants on their backs. The thighs and legs of the infants were bound at certain distances by broad strips of cotton cloth, and the flesh, strongly compressed beneath the ligatures, was swelled in the interstices. It is generally to be observed, that the Caribs are as attentive to their exterior and their ornaments, as it is possible for men to be, who are naked and painted red. They attach great importance to certain configurations of the body; and a mother would be accused of culpable indifference toward her children, if she did not employ artificial means to shape the calf of the leg after the fashion of the country. As none of our Indians of Apure understood the Caribbee language, we could obtain no information from the cacique of Panama respecting the encampments that are made at this season in several islands of the Orinoco for collecting turtles' eggs.

Near Encaramada a very long island divides the river into two branches. We passed the night in a rocky creek, opposite the mouth of the Rio Cabullare, which is formed by the Payara and the Atamaica, and is sometimes considered as one of the branches of the Apure, because it communicates with that river by the Rio Arichuna. The evening was beautiful. The moon illumined the tops of the granite rocks. The heat was so uniformly distributed, that, notwithstanding the humidity of the air, no twinkling of the stars was observable, even at four or five degrees above the horizon. The light of the planets was singularly dimmed; and if, on account of the smallness of the apparent diameter of Jupiter, I had not suspected some error in the observation, I should say, that here, for the first time, we thought we distinguished the disk of Jupiter with the naked eye. Towards midnight, the north-east wind became extremely violent. It brought no clouds, but the vault of the sky was covered more and more with vapours. Strong gusts were felt, and made us fear for the safety of our canoe. During this whole day we had seen very few crocodiles, but all of an extraordinary size, from twenty to twenty-four feet. The Indians assured us that the young crocodiles prefer the marshes, and the rivers that are less broad, and less deep. They crowd together particularly in the Caños, and we may say of them, what Abdallatif says of the crocodiles of the

Nile," "that they swarm like worms in the shallow waters of the river, and in the shelter of uninhabited islands."

On the 6th of April, whilst continuing to ascend the Orinoco, first southward and then to south-west, we perceived the southern side of the Serrania, or chain of the mountains of Encaramada. The part nearest the river is only one hundred and forty or one hundred and sixty toises high; but from its abrupt declivities, its situation in the midst of a savannah, and its rocky summits, cut into shapeless prisms, the Serrania appears singularly elevated. Its greatest breadth is only three leagues. According to information given me by the Indians of the Pareka nation, it is considerably wider toward the east. The summits of Encaramada form the northernmost link of a group of mountains which border the right bank of the Orinoco, between the latitudes of $5^{\circ}$ and $7^{\circ} 30^{\prime}$ from the mouth of the Rio Zama to that of the Cabullare. The different links into which this group is divided are separated by little grassy plains. They do not preserve a direction perfectly parallel to each other; for the most northern stretch from west to east, and the most southern from north-west to south-east. This change of direction sufficiently explains the increase of breadth observed in the Cordillera of Parime towards the east, between the sources of the Orinoco and of the Rio Paruspa. On penetrating beyond the great cataracts of Atures and of Maypures, we shall see seven principal links, those of Encaramada or Sacuina, of Chaviripa, of Baraguan, of Carichana, of Uniama, of Calitamini, and of Sipapo, successively appear. This sketch may serve to give a general idea of the geological configuration of the ground. We recognize everywhere on the globe a tendency toward regular forms, in those mountains that appear the most irregularly grouped. Every link appears, in a transverse section, like a distinct summit, to those who navigate the Orinoco; but this division is merely in appearance. The regularity in the direction and separation of the links seems to diminish in proportion as we advance towards the east. The mountains of Encaramada join those of Mato, which give birth to the Rio Asiveru or Cuchivero; those of Chaviripe are prolonged by the granite chain of the Corosal, of Amoco, and

- Description de l'Egypte, translated by De Sacy.
of Murcielago, towards the sources of the Erevato and the Ventuari.

It was across these mountains, which are inhabited by Indians of gentle character, employed in agriculture,* that, at the time of the expedition for settling boundaries, General Iturriaga took some horned cattle for the supply of the new town of San Fernando de Atabapo. The inhabitants of Encaramada then showed the Spanish soldiers the way by the Rio Manapiari, $\dagger$ which falls into the Ventuari. By descending these two rivers, the Orinoco and the Atabapo may be reached without passing the great cataracts, which present almost insurmountable obstacles to the conveyance of cattle. The spirit of enterprise which had so eminently distinguished the Castilians at the period of the discovery of America, was again roused for a time in the middle of the eighteenth century, when Ferdinand VI was desirous of knowing the true limits of his vast possessions; and in the forests of Guiana, that land of fiction and fabulous tradition, the wily Indians revived the chimerical idea of the wealth of El Dorado, which had so much occupied the imagination of the first conquerors.
Amidst the mountains of Encaramada, which, like most coarse-grained granite rocks, are destitute of metallic veins, we cannot help inquiring whence came those grains of gold which Juan Martinez $\ddagger$ and Raleigh profess to have seen in such abundance in the hands of the Indians of the Orinoco. From what I observed in that part of America, I am led to think that gold, like tin, $|\mid$ is sometimes disseminated in an

[^248]almost imperceptible manner in the very mass of granite rocks, without our being able to perceive that there is a ramification and an intertwining of small veins. Not long ago the Indians of Encaramada found in the Quebrada del Tigre* a piece of native gold two lines in diameter. It was rounded, and appeared to have been washed along by the waters. This discovery excited the attention of the missionaries much more than of the natives; it was followed by no other of the same kind.

I cannot quit this first link of the mountains of Encaramada without recalling to mind a fact that was not unknown to Father Gili, and which was often mentioned to me during our abode in the Missions of the Orinoco. The natives of those countries have retained the belief that, "at the time of the great waters, when their fathers were forced to have recourse to boats, to escape the general inundation, the waves of the sea beat against the rocks of Encaramada." This belief is not confined to one nation singly, the Tamanacs; it makes part of a system of historical tradition, of which we find scattered notions among the Maypures of the great cataracts; among the Indians of the Rio Erevato, which runs into the Caura; and among almost all the tribes of the Upper Orinoco. When the Tamanacs are asked how the human race survived this great deluge, the 'age of water,' of the Mexicans, they say, "a man and a woman saved themselves on a high mountain, called Tamanacu, situated on the banks of the Asiveru; and casting behind them, over their heads, the fruits of the mauritia palm-tree, they saw the seeds contained in those fruits produce men and women, who repeopled the earth." Thus we find in all its simplicity, among nations now in a savage state, a tradition which the Greeks embellished with all the charms of imagination! A few leagues from Encaramada, a rock, called Tepu-mereme, or 'the painted rock,' rises in the midst of the savannah. Upon it are traced representations of animals, and symbolic figures resembling those we saw in going down the Orinoco, at a small distance below Encaramada, near the town Caycara. Similar rocks in Africa are called by travellers fetish stones. I shall not make use of this term, because fetishism does not prevail among the natives of the Orinoco; and the * The Tiger-ravine.
figures of stars, of the sun, of tigers, and of crocodiles, which we found traced upon the rocks in spots now uninhabited, appeared to me in no way to denote the objects of worship of those nations. Between the banks of the Cassiquiare and the Orinoco, between Encaramada, the Capuchino, and Caycara, these hieroglyphic figures are often seen at great heights, on rocky cliffs which could be accessible only by constructing very lofty scaffolds. When the natives are asked how those figures could have been sculptured, they answer with a smile, as if relating a fact of which only a white man could be ignorant, that "at the period of the great waters, their fathers went to that height in boats."

These ancient traditions of the human race, which we find dispersed over the whole surface of the globe, like the relics of a vast shipwreck, are highly interesting in the philosophical study of our own species. Like certain families of the vegetable kingdom, which, notwithstanding the diversity of climates and the influence of heights, retain the impression of a common type, the traditions of nations respecting the origin of the world, display everywhere the same physiognomy, and preserve features of resemblance that fill us with astonishment. How many different tongues, belonging to branches that appear totally distinct, transmit to us the same facts! The traditions concerning races that have been destroyed, and the renewal of nature, scarcely vary in reality, though every nation gives them a local colouring. In the great continents, as in the smallest islands of the Pacific Ocean, it is always on the loftiest and nearest mountain that the remains of the human race have been saved; and this event appears the more recent, in proportion as the nations are uncultivated, and as the knowledge they have of their own existence has no very remote date. After having studied with attention the Mexican monuments, anterior to the discovery of the New World; after having penetrated into the forests of the Orinoco, and observed the diminutite size of the European establishments, their solitude, and the state of the tribes that have remained independent; we cannot allow ourselves to attribute the analogies just cited to the influence exercised by the missionaries, and by Christianity, on the national traditions. Nor is it more probable, that the discovery of sea-shells on
the summit of mountains gave birth, among the nations of the Orinoco, to the tradition of some great inundation which extinguished for a time the germs of organic life on our globe. The country that extends from the right bank of the Orinoco to the Cassiquiare and the Rio Negro, is a country of primitive rocks. 1 saw there one small formation of sandstone or conglomerate ; but no secondary limestone, and no trace of petrifactions.

A fresh north-east breeze carried us full-sail towards the Buca de la Tortuga. We landed, at eleven in the morning, on an island which the Indians of the Missions of Uruana considered as their property, and which lies in the middle of the river. This island is celebrated for the turtle fishery, or, as they say here, the cosecha, 'the harvest [of eggs,]' that takes place annually. We here found an assemblage of Indians, encamped under huts made of palm-leaves. This encampment contained more than three hundred persons. Accustomed, since we had left San Fernando de Apure, to see only desert shores, we were singularly struck by the bustle that prevailed here. We found, besides the Guamos and the Ottomacs of Uruana, who are both considered as savage races, Caribs and other Indians of the Lower Orinoco. Every tribe was separately encamped, and was distinguished by the pigments with which their skins were painted. Some white men were seen amidst this tumultuous assemblage, chiefly pulperos, or little traders of Angostura, who had come up the river to purchase turtle oil from the natives. The missionary of Uruana, a native of Alcala, came to meet us, and he was extremely astonished at seeing us. After having admired our instruments, he gave us an exaggerated picture of the sufferings to which we should be necessarily exposed in ascending the Orinoco beyond the cataracts. The object of our journey appeared to him very mysterious. "How is it possible to believe," said he, "that you have left your country, to come and be devoured by mosquitos on this river, and to measure lands that are not your own?" We were happily furnished with recommendations from the Superior of the Franciscan Missions, and the brother-in-law of the governor of Varinas, who accompanied us, soon dissipated the doubts to which our dress, our accent, and our arrival in this sandy island,
had given rise among the Whites. The missionary invited us to partake a frugal repast of fish and plantains. He told us that he had come to encamp, with the Indians during the time of the 'harvest of eggs,' "to celebrate mass every morning in the open air, to procure the oil necessary for the church-lamps, and especially to govern this mixed republic (república de Indios y Castellanos) in which every one wished to profit singly by what God had granted to all."
We made the tour of the island, accompanied by the missionary and by a pulpero, who boasted of having, for ten successive years, visited the camp of the Indians, and attended the turtle-fishery. We were on a plain of sand perfectly smooth; and were told that, as far as we could see along the beach, turtles' eggs were concealed under a layer of earth. The missionary carried a long pole in his hand. He showed us, that by means of this pole, the extent of the stratum of eggs could be determined as accurately as the miner determines the limits of a bed of marl, of bog ironore, or of coal. On thrusting the rod perpendicularly into the ground, the sudden want of resistance shows that the cavity or layer of loose earth containing the eggs, has been reached. We saw that the stratum is generally spread with so much uniformity, that the pole finds it everywhere in a radius of ten toises around any given spot. Here they talk continually of square perches of eggs; it is like a miningcountry, divided into lots, and worked with the greatest regularity. The stratum of eggs, however, is far from covering the whole island: they are not found wherever the ground rises abruptly, because the turtle cannot mount heights. I related to my guides the emphatic description of Father Gumilla, who asserts, that the shores of the Orinoco contain fewer grains of sand than the river contains turtles; and that these animals would prevent vessels from advancing, if men and tigers did not annually destroy so great a number." "Son cuentos de frailes," "they are

* "It would be as difficult to count the grains of sand on the shores of the Orinoco, as to count the immense number of tortoises which inhabit its margins and waters. Were it not for the vast consumption of tortoises and their eggs, the river Orinoco, despite its great magnitude, would be unnavigable, for vessels would be impeded by the enormous multitude of the tortoises."-Gumilla, Orinoco Illustrata, vol. i. pp. 331-336.
monkish legends," said the pulpero of Angostura, in a low voice; for the only travellers in this country being the missionaries, they here call 'monks' stories,' what we call 'travellers' tales,' in Europe.

The Indians assured us that, in going up the Orinoco from its mouth to its junction with the Apure, not one island or one beach is to be found, where eggs can be collected in abundance. The great turtle (arrau)* dreads places inhabited by men, or much frequented by boats. It is a timid and mistrustful animal, raising only its head above the water, and hiding itself at the least noise. The shores where almost all the turtles of the Orinoco appear to assemble annually, are situated between the junction of the Orinoco with the Apure, and the great cataracts; that is to say, between Cabruta and the Mission of Atures. There are found the three famous fisheries; those of Encaramada, or Boca del Cabullare; of Cucuruparu, or Boca de la Tortuga ; and of Pararuma, a little below Carichana. It seems that the arrau does not pass beyond the cataracts; and we were assured, that only the turtles called terekay, (in Spanish terecayas,) are found above Atures and Maypures.

The arrau, called by the Spaniards of the Missions simply tortuga, is an animal whose existence is of great importance to the nations on the Lower Orinoco. It is a large freshwater tortoise, with palmate and membraneous feet; the head very flat, with two fleshy and acutely-pointed appendages under the chin; five claws to the fore feet, and four to the hind feet, which are furrowed underneath. The upper shell has five central, eight lateral, and twenty-four marginal plates. The colour is darkish grey above, and orange beneath. The feet are yellow, and very long. There is a deep furrow between the eyes. The claws are very strong and crooked. The anus is placed at the distance of one-fifth from the extremity of the tail. The full-grown animal weighs from forty to fifty pounds. Its eggs are much larger than those of pigeons, and less elongated than the eggs of the terekay. They are covered with a calcareous crust, and, it is

[^249]said, they have sufficient firmness for the children of the Ottomac Indians, who are great players at ball, to throw them into the air from one to another. If the arrau inhabited the bed of the river above the cataracts, the Indians of the Upper Orinoco would not travel so far to procure the flesh and the eggs of this tortoise. . Yet, formerly, whole tribes from the Atabapo and the Cassiquiare have been known to pass the cataracts, in order to take part in the fishery at Uruana.
The terekay is less than the arrau. It is in general only fourteen inches in diameter. The number of plates in the upper shell is the same, but they are somewhat differently arranged. I counted three in the centre of the disk, and five hexagonal on each side. The margins contain twentyfour, all quadrangular, and much curved. The upper shell is of a black colour inclining to green; the feet and claws are like those of the arrau. The whole animal is of an olive-green, but it has two spots of red mixed with yellow on the top of the head. The throat is also yellow, and furnished with a prickly appendage. The terekays do not assemble in numerous societies like the arraus, to lay tneir eggs in counmon, and deposit them upon the same shore. The eggs of the terekay have an agreeable taste, and are much sought after by the inhabitants of Spanish Guiana. They are found in the Upper Orinoco, as well as below the cataracts, and even in the Apure, the Uritucu, the Guarico, and the small rivers that traverse the Llanos of Caracas. The form of the feet and head, the appendages of the chin and throat, and the position of the anus, seem to indicate that the arrau, and probably the terekay also, belong to a new subdivision of the tortoises, that may be separated from the emydes. The period at which the large arrau tortoise lays its eggs coincides with the period of the lowest waters. The Orinoco beginning to increase from the vernal equinox, the lowest flats are found uncovered from the end of January till the 20th or 25th of March. The arrau tortoises collect in troops in the month of January, then issue from the water, and warm themselves in the sun, reposing on the sands. The Indians believe that great heat is indispensable to the health of the animal, and that its expo-
sure to the sun favours the laying of the eggs. The arraus are found on the beach a great part of the day during the whole monthoof February. At the beginning of March the straggling troops assemble, and swim towards the small number of islands on which they habitually deposit their eggs. It is probable that the same tortoise returns every year to the same locality. At this period, a few days before they lay their eggs, thousands of these animals may be seen ranged in long files, on the borders of the islands of Cucuruparu, Uruana, and Pararuma, stretching out their necks and holding their heads above water, to see whether they have anything to dread. The Indians, who are anxious that the bands when assembled should not separate, that the tortoises should not disperse, and that the laying of the eggs should be performed tranquilly, place sentinels at certain distances along the shore. The people who pass in boats are told to keep in the middle of the river, and not frighten the tortoises by cries. The laying of the eggs takes place always during the night, and it begins soon after sunset. With its hind feet, which are very long, and furnished with crooked claws, the animal digs a hole of three feet in diameter and two in depth. These tortoises feel so pressing a desire to lay their eggs, that some of them descend into holes that have been dug by others, but which are not yet covered with earth. There they deposit a new layer of eggs on that which has been recently laid. In this tumultuous movement an immense number of eggs are broken. The missionary showed us, by removing the sand in several places, that this loss probably amounts to a fifth of the whole quantity. The yolk of the broken eggs contributes, in drying, to cement the sand; and we found very large concretions of grains of quartz and broken shells. The number of animals working on the beach during the night is so considerable, that day surprises many of them before the laying of their eggs is terminated. They are then urged on by the double necessity of depositing their eggs, and closing the holes they have dug, that they may not be perceived by the jaguars. The tortoises that thus remain too late are insensible to their own danger. They work in the presence of the Indians, who visit the beach
at a very early hour, and who call them 'mad tortoises.' Notwithstanding the rapidity of their movements, they are then easily caught with the hand.

The three encampments formed by the Indians, in the places indicated above, begin about the end of March or commencement of April. The gathering of the eggs is conducted in a uniform manner, and with that regularity which characterises all monastic institutions. Before the arrival of the missionaries on the banks of the river, the Indians profited much less from a production which nature has supplied in such abundance. Every tribe searched the beach in its own way; and an immense number of eggs were uselessly broken, because they were not dug up with precaution, and more eggs were uncovered than could be carried away. It was like a mine worked by unskilful hands. The Jesuits have the merit of having reduced this operation to regularity; and though the Franciscan monks, who succeeded the Jesuits in the Missions of the Orinoco, boast of having followed the example of their predecessors, they unhappily do not effect all that prudence requires. The Jesuits did not suffer the whole beach to be searched; they left a part untouched, from the fear of seeing the breed of arrau tortoises, if not destroyed; at least considerably diminished. The whole beach is now dug up without reserve; and accordingly it seems to be perceived that the gathering is less productive from year to year.

When the camp is formed, the missionary of Uruana names his lieutenant, or commissary, who divides the ground where the eggs are found into different portions, according to the number of the Indian tribes who take part in the gathering. ' They are all 'Indians of Missions,' as naked and rude as the 'Indians of the woods;' though they are called reducidos and neofitos, because they go to church at the sound of the bell, and have learned to kneel down during the consecration of the host.

The lieutenant (commissionado del Padre) begins his operations by sounding. He examines by means of a long wooden pole or a cane of bamboo, how far the stratum of eggs extends. This stratum, according to our measurements, extended to the distance of one hundred and twenty feet from the shore. Its average depth is three feet. The commis-
sionado places marks to indicate the point where each tribe should stop in its labours. We were surprised to hear this 'harvest of eggs' estimated like the produce of a wellcultivated field. An area accurately measured of one hundred and twenty feet long, and thirty feet wide, has been known to yield one hundred jars of oil, valued at about forty pounds sterling. The Indians remove the earth with their hands; they place the eggs they have collected in small baskets, carry them to their encampment, and throw them into long troughs of wood filled with water. In these troughs the eggs, broken and stirred with shovels, remain exposed to the sun till the oily part, which swims on the surface, has time to inspissate. As fast as this collects on the surface of the water, it is taken off and boiled over a quick fire. This animal oil, called tortoise butter (manteca de tortugas)* keeps the better, it is said, in proportion as it has undergone a strong ebullition. When well prepared, it is limpid, inodorous, and scarcely yellow. The missionaries compare it to the best olive oil, and it is used not merely for burning in lamps, but for cooking. It is not easy, however, to procure oil of turtles' eggs quite pure. It has generally a putrid smell, owing to the mixture of eggs in which the young are already formed.

I acquired some general statistical notions on the spot, by consulting the missionary of Uruana, his lieutenant, and the traders of Angostura. The shore of Uruana furnishes one thousand botijas, or jars of oil, annually. . The price of each jar at Angostura varies from two piastres to two and a half. We may admit that the total produce of the three shores, where the cosecha, or gathering of eggs, is annually made, is five thousand botijas. Now as two hundred eggs yield oil enough to fill a bottle (limeta), it requires five thousand eggs for a jar or botija of oil. Estimating at one hundred, or. one hundred and sixteen, the number of eggs that one tortoise produces, and reckoning that one third of these is broken at the time of laying, particularly by the 'mad tortoises,' we may presume that, to obtain annually five thousand jars of oil, three hundred and thirty thousand arrau tortoises, the weight of which amounts to one hundred

[^250]and suxty-five thousand quintals, must lay thirty-three millions of eggs on the three shores where this harvest is gathered. The results of these calculations are much below the truth. Many tortoises lay only sixty or seventy eggs; and a great number of these animals are devoured by jaguars at the moment they emerge from the water. The Indians bring away a great number of eggs to eat them dried in the sun; and they break a considerable number through carelessness during the gathering. The number of eggs that are hatched before the people can dig them up is so prodigious, that near the encampment of Uruana I saw the whole shore of the Orinoco swarming with little tortoises an inch in diameter, escaping with difficulty from the pursuit of the Indian children. If to these considerations be added, that all the arraus do not assemble on the three shores of the encampments; and that there are many which lay their eggs in solitude, and some weeks later,* between the mouth of the Orinoco and the confluence of the Apure; we must admit that the number of turtles which annually deposit their eggs on the banks of the Lower Orinoco, is near a million. This number is very great for so large an animal. In general large animals multiply less considerably than the smaller ones.

The labour of collecting the eggs, and preparing the oil, occupies three weeks. It is at this period only that the missionaries have any communication with the coast and the civilized neighbouring countries. The Franciscan monks who live south of the cataracts, come to the 'harvest of eggs' less to procure oil, than to see, as they say, 'white faces;' and to learn whether the king inhabits the Escurial or San Ildefonso, whether convents are still suppressed in France, and above all, whether the Turks continue to keep quiet. On these subjects, (the only ones interesting

[^251]to a monk of the Orinoco), the small traders of Angostura, who visit the encampments, can give, unfortunately, no very exact information. But in these distant countries no doubt is ever entertained of the news brought by a white man from the capital. The profit of the traders in oil amounts to seventy or eighty per cent.; for the Indians sell it them at the price of a piastre a jar or botija, and the expense of carriage is not more than two-fifths of a piastre per jar. The Indians bring away also a considerable quantity of eggs dried in the sun, or slightly boiled. Our rowers had baskets, or little bags of cotton-cloth filled with these eggs. Their taste is not disagreeuble, when well preserved. We were shown large shells of turtles, which had been destroyed by the jaguars. These animals follow the arraus towards those places on the beach where the eggs are laid. They surprise the arraus on the sand; and, in order to devour them at their ease, turn them in such a manner that the under shell is uppermost. In this situation the turtles cannot rise; and as the jaguar turns many more than he can eat in one night, the Indians often avail themselves of his cunning and avidity.
When we reflect on the difficulty experienced by the naturalist in getting out the body of the turtle without separating the upper and under shells, we cannot sufficiently wonder at the suppleness of the tiger's paw, which is able to remove the double armour of the arrau, as if the adhering parts of the muscles had been cut by a surgical instrument. The jaguar pursues the turtle into the water when it is not very deep. It even digs up the eggs; and together with the crocodile, the heron, and the galinazo vulture, is the most cruel enemy of the little turtles recently hatched. The island of Pararuma had been so much infested with crocodiles the preceding year, during the egg-harvest, that the Indians in one night caught eighteen, of twelve or fifteen feet long, by means of curved pieces of iron, baited with the flesh of the manati. Besides the beasts of the forests we have just named, the wild Indians also very much diminish the quantity of the oil. Warned by the first slight rains, which they call 'turtle-rains' (peje canepori), * they hasten to the banks of the Orinoco, and kill the turtles with poi-

[^252]soned arrows, whilst, with upraised heads and paws extended, the animals are warming themselves in the sun.

Though the little turtles (tortuguillos) may have burst' the shells of their eggs during the day, they are never seen to come out of the ground but at night. The Indians assert that the young animal fears the heat of the sun. They tried also to show us, that when the tortuguillo is carried in a bag to a distance from the shore, and placed in such a manner that its tail is turned to the river, it takes without hesitation the shortest way to the water. I confess, that this experiment, of which Father Gumilla speaks, does not always succeed equally well: yet in general it does appear that at great distances from the shore, and even in an island, these little animals feel with extreme delicacy in what direction the most humid air prevails.

Reflecting on the almost uninterrupted layer of eggs that extends along the beach, and on the thousands of little turtles that seek the water as soon as they are hatched, it is difficult to admit that the many turtles which have made their nests in the same spot, can distinguish their own young, and lead them, like the crocodiles, to the lakes in the vicinity of the Orinoco. It is certain, however, that the animal passes the first years of its life in pools where the water is shallow, and does not return to the bed of the great river till it is full-grown. How then do the tortuguillos find these pools? Are they led thither by female turtles, which adopt the young as by chance? The crocodiles, less numerous, deposit their eggs in separate holes; and, in this family of saurians, the female returns about the time when the incubation is terminated, calls her young, which answer to her voice, and often assists them to get out of the ground. The arrau tortoise, no doubt, like the crocodile, knows the spot where she has made her nest; but, not daring to return to the beach on which the Indians have formed their encampment, how can she distinguish her own young from those which do not belong to her? On the other hand, the Ottomac Indians declare that, at the period of inundation, they have met with female turtles followed by a great number of young ones. These were perhaps arraus whose eggs had been deposited on a desert beach to which they could return. Males are extremely rare among these vOL. II.
animals. Scarcely is one male found among several hundred females. The cause of this disparity cannot be the same as with the crocodiles, which fight in the coupling season.

Our pilot had anchored at the Playa de huevos, to purchase some provisions, our store having began to run short. We found there fresh meat, Angostura rice, and even biscuit made of wheat-flour. Our Indians filled the boat with little live turtles, and eggs dried in the sun, for their own use. Having taken leave of the missionary of Uruana, who had treated us with great kindness, we set sail about four in the afternoon. The wind was fresh, and blew in squalls. Since we had entered the mountainous part of the country, we had discovered that our canoe carried sail very badly; but the master was desirous of showing the Indians who were assembled on the beach, that, by going close to the wind, he could reach, at one single tack, the middle of the river. At the very moment when he was boasting of his dexterity, and the boldness of his manourre, the force of the wind upon the sail became so great that we were on the point of going down. One side of the boat was under water, which rushed in with such violence that it was soon up to our knees. It washed over a little table at which I wae writing at the stern of the boat. I had some difficulty to save my journal, and in an instant we saw our books, papers, and dried plants, all afloat. M. Bonpland was lying asleep in the middle of the canoe. Awakened by the entrance of the water and the cries of the Indians, he understood the danger of our situation, whilst he maintained that coolness which he always displayed in the most difficult circumstances. The lee-side righting itself from time to time during the squall, he did not consider the boat as lost. He thought that, were we even forced to abandon it, we might save ourselves by swimming, since there was no crocodile in sight. Amidst this uncertainty the cordage of the sail suddenly gave way. The same gust of wind, that had thrown us on our beam, served also to right us. We laboured to bale the water out of the boat with calabashes, the sail was again set, and in less than half an hour we were in a state to proceed. The wind now abated a little. Squalls alternating with dead calms are common in that part of the Orinoco which
is bordered by mountains. They are very dangerous for boats deeply laden, and without decks. We had escaped as if by miracle. To the reproaches that were heaped on our pilot for having kept too near the wind, he replied with the phlegmatic coolness peculiar to the Indians, observing "that the whites would find sun enough on those banks to dry their papers." We lost only one book-the first volume of the 'Genera Plantarum' of Schreber-which had fallen overboard. At nightfall we landed on a barren island in the middle of the river, near the Mission of Uruans. We supped in a clear moonlight, seating ourselves on some large turtle-shells that were found scattered about the beach. What satisfaction we felt on finding ourselves thus comfortably landed! We figured to ourselves the situation of a man who had been saved alone from shipwreck, wandering on these desert shores, meeting at every step with otber rivers which fall into the Orinoco, and which it is dangerous to pass by swimming, on account of the multitude of crocodiles and caribe fishes. We pictured to ourselves such a man, alive to the most tender affections of the soul, ignorant of the fate of his companions, and thinking more of them than of himself. If we love to indulge such melancholy meditations, it is because, when just escaped from danger, we seem to feel as it were the neeessity of strong emotions. Our minds were full of what we had just witnessed. There are periods in life when, without being discouraged, the future appears more uncertain. It was only three days since we had entered the Orinoco, and there yet remained three months for us to navigate rivers encumbered with rocks, and in boats smaller than that in which we had so nearly perished.

The night was intensely hot. We lay upon skins spread on the ground, there being no trees to which we could fasten our hammocks. The torments of the mosquitos incrensed every day; and we were surprised to find that on this spot our fires did not prevent the approach of the jaguars. They swam across the arm of the river that separated us from the mainland. Towards morning we heard their cries very near. They had come to the island where we passed the night. The Indians told us that, during the collecting of the turtles' eggs, tigers are always more fre02
quent in those regions, and display at that period the greatest intrepidity.

On the following day, the 7th, we passed, on our right, the mouth of the great Rio Auraca, celebrated for the immense number of birds that frequent it; and, on our left, the Mission of Uruana, commonly called La Concepcion de Urbana. This small village, which contains five hundred souls, was founded by the Jesuits, about the year 1748, by the union of the Ottomac and Cavere Indians. It lies at the foot of a mountain composed of detached blocks of granite, which, I believe, bears the name of Saraguaca. Masses of rock, separated one from the other by the effect of decomposition, form caverns, in which we find indubitable proofs of the ancient civilization of the natives. Hieroglyphic figures, and even characters in regular lines, are seen sculptured on their sides; though I doubt whether they bear any analogy to alphabetic writing. We visited the Mission of Uruana on our return from the Rio Negro, and saw with our own eyes those heaps of earth which the Ottomacs eat, and which have become the subject of such lively discussion in Europe.*

On measuring the breadth of the Orinoco between the islands called Isla de Uruana and Isla de la Manteca, we found it, during the high waters, 2674 toises, which make nearly four nautical miles. This is eight times the breadth of the Nile at Manfalout and Syout, yet we were at the distance of a hundred and ninety-four leagues from the mouth of the Orinoco.

The temperature of the water at its surface was $27.8^{\circ}$ of the centigrade thermometer, near Uruana. That of the river Zaire, or Congo, in Africa, at an equal distance from the equator, was found by Captain Tuckey, in the months of July and August, to be only from $23 \cdot 9^{\circ}$ to $25 \cdot 6^{\circ}$.

The western bank of the Orinoco remains low farther

* This earth is a greasy kind of clay, which, in seasons of scarcity, the natives use to assuage the cravings of hunger; it having been proved by their experience as well as by physiological researches, that want of food can be more easily borne by filling the cavity of the stomach with some substance, even although it may be in itself very nearly or totally innutritious. The Indian hanters of North America, for the same purpose, tie boards tightly across the abdomen; and most savage races are found to have recourse to expedients that answer the same end.
than the mouth of the Meta; while from the Mission of Uruana the mountains approach the eastern bank more and more. As the strength of the current increases in proportion as the river grows narrower, the progress of our boat became much slower. We continued to ascend the Orinoco under sail, but the high and woody grounds deprived us of the wind. At other times the narrow passes between the mountains by which we sailed, sent us violent gusts, but of short duration. The number of crocodiles increased below the junction of the Rio Arauca, particularly opposite the great lake of Capanaparo, which communicates with the Orinoco, as the Laguna de Cabullarito communicates at the same time with the Orinoco and the Rio Arauca. The Indians told us that the crocodiles came from the inlands, where they had been buried in the dried mud of the savannahs. As soon as the first showers arouse them from their lethargy, they crowd together in troops, and hasten toward the river, there to disperse again. Here, in the equinoctial zone, it is the increase of humidity that recalls them to life; while in Georgia and Florida, in the temperate zone, it is the augmentation of heat that rouses these animals from a state of nervous and muscular debility, during which the active powers of respiration are suspended or singularly diminished. The season of great drought, improperly called the summer of the torrid zone, corresponds with the winter of the temperate zone; and it is a curious physiological phenomenon to observe the alligators of North America plunged into a winter-sleep by excess of cold, at the same period when the crocodiles of the Llanos begin their siesta or summer-sleep. If it were probable that these animals of the same family had heretofore inhabited the same northern country, we might suppose that, in advancing towards the equator, they feel the want of repose after having exercised their muscles for seven or eight months, and that they retain under a new sky the habits which appear to be essentially linked with their organization.

Having passed the mouths of the channels communicating with the lake of Capanaparo, we entered a part of tho Orinoco, where the bed of the river is narrowed by the mountains of Baraguan. It is a kind of strait, reaching
nearly to the confluence of the Rio Suapure. From these granite mountains the natives heretofore gave the name of Baraguan to that part of the Orinoco comprised between the mouths of the Arauca and the Atabapo. Among sarvage nations great rivers bear different denominations in the different portions of their course. The Passage of Baraguan presents a picturesque scene. The granite rocks are perpendicular. They form a range of mountains lying north-west and south-east; and the river cutting this dyke nearly at a right angle, the summits of the mountains appear like separate peaks. Their elevation in general does not surpass one hundred and twenty toises; but their situation in the midst of a small plain, their steep declivities, and their flanks destitute of vegetation, give them a majestic character. They are composed of enormous masses of granite of a parallelopipedal figure, but rounded at the edges, and heaped one upon another. The blocks are often eighty feet long, and twenty or thirty broad. They would seem to have been piled up by some external force, if the prorimity of a rock identical in its composition, not separated into blocks but filled with veins, did not prove that the parallelopipedal form is owing solely to the action of the atmosphere. These veins, two or three inches thick, are distinguished by a fine-grained quartz-granite crossing a coarse-grained granite almost porphyritic, and abounding in fine crystals of red feldspar. I sought in vain, in the Cordillera of Baraguan, for hornblende, and those steatitic masses that characterise several granites of the Higher Alps in Switzerland.

We landed in the middle of the strait of Baraguan to measure its breadth. The rocks project so much towards the river that I measured with difficulty a base of eighty toises. I found the river eight hundred and eighty-nine toises broad. In order to conceive how this passage bears the name of a strait, we must recollect that the breadth of the river from Uruana to the junction of the Meta is in general from 1500 to 2500 toises. In this place, which is extremely hot and barren, I measured two granite summits, much rounded: one was only a hundred and ten, and the other eighty-five, toises. There are higher summits in the
interior of the group, but in general these mountains, of so wild an aspect, have not the elevation that is assigned to them by the missionaries.

We looked in vain for plants in the clefts of the rocks, which are as steep as walls, and furnish nome traces of stratification. We found only an old trunk of aubletia,* with large apple-shaped fruit, and a new species of the family of the apocynes. $\dagger$ All the stones were covered with an innumerable quantity of iguanas and geckos with spreading and membranous fingers. These lizards, motionless, with heads raised, and mouths open, seemed to suck in the heated air. The thermometer placed against the rock rose to $50.2^{\circ}$. The soil appeared to undulate, from the effect of mirage, without a breath of wind being felt. The sun was near the zenith, and its dazzling light, reflected from the surface of the river, contrasted with the reddish vapours that enveloped every surrounding object. How vivid is the impression produced by the calm of nature, at noon, in these burning climates! The beasts of the forests retire to the thickets; the birds hide themselves beneath the foliage of the trees, or in the crevices of the rocks. Yet, amidst this apparent silence, when we lend an attentive ear to the most feeble sounds transmitted through the air, we hear a dull vibration, a continual murmur, a ham of insects, filling, if we may use the expression, all the lower strata of the air. Nothing is better fitted to make man feel the extent and power of organic life. Myriads of insects creep upon the soil, and flutter round the plants parched by the heat of the sun. A confused noise issues from every bush, from the decayed trunks of trees, from the clefts of the rocks, and from the ground undermined by lizards, millepedes, and cecilias. These are so many voices proclaiming to us that all nature breathes; and that, under a thousand different forms, life is diffused throughout the cracked and dusty soil, as well as in the bosom of the waters, and in the air that circulates around us.

The sensations which I here recall to mind are not unknown to those who, without having advanced to the equator, have visited Italy, Spain, or Egypt. That contrast of motion and silence, that aspect of nature at once calm and
animated, strikes the imagination of the traveller when he enters the basin of the Mediterranean, within the zone of olives, dwarf palms, and date-trees.

We passed the night on the eastern bank of the Orinoco, at the foot of a granitic hill. Near this desert spot was formerly seated the Mission of San Regis. We could have wished to find a spring in the Baraguan, for the water of the river had a smell of musk, and a sweetish taste extremely disagreeable. In the Orinoco, as well as in the Apure, we are struck with the difference observable in the various parts of the river near the most barren shore. The water is sometimes very drinkable, and sometimes seems to be loaded with a slimy matter. "It is the bark (meaning the coriaceous covering) of the putrified cayman that is the cause," say the natives. "The more aged the cayman, the more bitter is his bark." I have no doubt that the carcasses of these large reptiles, those of the manatis, which weigh five hundred pounds, and the presence of the porpoises (toninas) with their mucilaginous skin, may contaminate the water, especially in the creeks, where the river has little velocity. Yet the spots where we found the most fetid water, were not always those where dead animals were accumulated on the beach. When, in such burning climates, where we are constantly tormented by thirst, we are reduced to drink the water of a river at the temperature of $27^{\circ}$ or $28^{\circ}$, we cannot help wishing at least that water so hot, and so loaded with sand, should be free from smell.

On the 8th of April we passed the mouths of the Suapure or Sivapuri, and the Caripo, on the east, and the outlet of the Sinaruco on the west. This last river is, next to the Rio Arauca, the most considerable between the Apure and the Meta. The Suapure, full of little cascades, is celebrated among the Indians for the quantity of wild honey obtained from the forests in its neighbourhood. The melipones there suspend their enormous hives to the branches of trees. Father Gili, in 1766, made an excursion on the Suapure, and on the Turiva, which falls into it. He there found tribes of the nation of Areverians. We passed the night a little below the island Macapina.

Early on the following morning we arrived at the beach of Pararuma, where we fisund an encampment of Indians,
similar to that we had seen at the Boca de la Tortuga. They had assembled to search the sands, for collecting the turtles' eggs, and extracting the oil; but they had unfortunately made a mistake of several days. The young turtles had come out of their shells before the Indians had formed their camp; and consequently the crocodiles and the garzes, a species of large white herons, availed themselves of the delay. These animals, alike fond of the flesh of the young turtles, devour an innumerable quantity. They fish during the night, for the tortuguillos do not come out of the earth to gain the neighbouring river till after the evening twilight. The zamuro vultures are too indolent to hunt after sunset. They stalk along the shores in the daytime, and alight in the midst of the Indian encampment to steal provisions; but they often find no other means of satisfying their voracity than by attacking young crocodiles of seven or eight inches long, either on land or in water of little depth. It is curious to see the address with which these little animals defend themselves for a time against the vultures. As soon as they perceive the enemy, they raise themselves on their fore paws, bend their backs, and lift up their heads, opening their wide jaws. They turn continually, though slowly, toward their assailant to show him their teeth, which, even when the animal has but recently issued from the egg, are very long and sharp. Often while the attention of a young crocodile is wholly engaged by one of the zamuros, another seizes the favourable opportunity for an unforeseen attack. He pounces on the crocodile, grasps him by the neck, and bears him off to the higher regions of the air. We had an opportunity of observing this manœurre during several mornings, at Mompex, on the banks of the Magdalena, where we had collected more than forty very young crocodiles, in a spacious court surrounded by a wall.

We found among the Indians assembled at Pararuma some white men, who had come from Angostura to purchase the tortoise-butter. After having wearied us for a long time with their complaints of the 'bad harvest,' and the mischief done by the tigers among the turtles, at the time of laying their eggs, they conducted us beneath an ajoupa, that rose in the centre of the Indian camp. We there found the missionary-monks of Carichana and the

Cataracts seated on the ground, playing at cards, and smoking tobacco in long pipes. Their ample blue garments, their shaven heads, and their long beards, might have led us to mistake them for natives of the East. These poor priests received us in the kindest manner, giving us every information necessary for the continuation of our voyage. They had suffered from tertian fever for some months; and their pale and emaciated aspect easily convinced us that the countries we were about to visit were not without danger to the health of travellers.

The Indian pilot, who had brought us from San Fernando de Apure as far as the shore of Pararuma, was unacquainted with the passage of the rapids* of the Orinoco, and would not undertake to conduct our bark any farther. We were obliged to conform to his will. Happily for us, the missionary of Carichana consented to sell us a fine canoe at a very moderate price: and Father Bernardo Zea, missionary of the Atures and Maypures near the great cataracts, offered, though still unwell, to accompany us as far as the frontiers of Brazil. The number of natives who can assist in griding boats through the Raudales is so inconsiderable that, but for the presence of the monk, we should have risked spending whole weeks in these humid and unhealthy regions. On the banks of the Orinoco, the forests of the Rio Negro are considered as delicious spots. The air is indeed cooler and more healthful. The river is free from crocodiles; one may bathe without apprehension, and by night as well as by day there is less torment from the sting of insects than on the Orinoco. Father Zea hoped to reestablish his health by visiting the Missions of Rio Negro. He talked of those places with that enthusiasm which is felt in all the colonies of South America for everything far off.

The assemblage of Indians at Pararuma again excited in us that interest, which everywhere attaches man in a cultivated state to the study of man in a savage condition, and the successive development of his intellectual faculties. How difficult to recognize in this infancy of society, in this assemblage of dull, silent, inanimate Indians, the primitive character of our species! Human nature does not here manifest those featares of artless simplicity, of which - Little cascades (chorros raudalitos).
poets in every language have drawn such enchanting pictares. The savage of the Orinoco appeared to us to be as hideous as the savage of the Mississippi, described by that philosophical traveller Volney, who so well knew how to paint man in different climates. We are eager to persuade ourselves that these natives, crouching before the fire, or seated on large turtle-shells, their bodies covered with earth and grease, their eyes stupidly fixed for whole hours on the beverage they are preparing, far from being the primitive type of our species, are a degenerate race, the feeble remains of nations who, after having been long dispersed in the forests, are replunged into barbarism.

Red paint being in some sort the only clothing of the Indians, two kinds may be distinguished among them, according as they are more or less affluent. The common decoration of the Caribs, the Ottomacs, and the Jaruros, is onoto,* called by the Spaniards achote, and by the planters of Cayenne, recou. It is the colouring matter extracted from the pulp of the Bixa orellans.t The Indian women prepare the anato by throwing the seeds of the plant into a tub filled with water. They beat this water for an hour, and then leave it to deposit the colouring fecula, which is of an intense brick-red. After having separated the water, they take out the fecula, dry it between their hands, knead it with oil of turtles' eggs, and form it into round cakes of three or four ounces weight. When turtle oil is wanting, some tribes mix with the anato the fat of the crocodile.

Another pigment, much more valuable, is extracted from a plant of the family of the bignoniz, which M. Bonpland has made known by the name of Bignonia chica. It climbs ap and clings to the tallest trees by the aid of tendrils. Its bilabiate flowers are an inch long, of a fine violet colour, sand disposed by twos or threes. The bipinnate leaves become reddish in drying. The fruit is a pod, filled with winged seeds, and is two feet long. This plant grows

[^253]spontaneously, and in great abundance, near Maypures ; and in going up the Orinoco, beyond the mouth of the Guaviare, from Santa Barbara to the lofty mountain of Duida, particularly near Esmeralda. We also found it on the banks of the Cassiquiare. The red pigment of chica is not obtained from the fruit, like the onoto, but from the leaves macerated in water. The colouring matter separates in the form of a light powder. It is collected, without being mixed with turtle-oil, into little lumps eight or nine inches long, and from two to three high, rounded at the edges. These lumps, when heated, emit an agreeable smell of benzoin. When the chica is subjected to distillation, it yields no sensible traces of ammonia. It is not, like indigo, a substance combined with azote. It dissolves slightly in sulphuric and muriatic acids, and even in alkalis. Ground with oil, the chica furnishes a red colvur that has a tint of lake. Applied to wool, it might be confounded with mad-der-red. There is no doubt but that the chica, unknown in Europe before our travels, may be employed usefully in the arts. The nations on the Orinoco, by whom this pigment is best prepared, are the Salivas, the Guipunaves,* the Caveres, and the Piraoas. The processes of infusion and maceration are in general very common among all the nations on the Orinoco. Thus the Maypures carry on a trade of barter with the little loaves of puruma, which is a vegetable fecula, dried in the manner of indigo, and yielding a very permanent yellow colour. The chemistry of the savage is reduced to the preparation of pigments, that of poisons, and the dulcification of the amylaceous roots, which the aroides and the euphorbiaceous plants afford.

Most of the missionaries of the Upper and Lower Orinoco permit the Indians of their Missions to paint their skins. It is painful to add, that some of them speculate on this barbarous practice of the natives. In their huts, pompously called conventos, $\dagger$ I have often seen stores of chica, which they sold as high as four francs the cake. To form a just idea of the extravagance of the decoration of these naked Indians, I must observe, that a man of large

[^254]stature gains with difficulty enough by the labour of a fortnight, to procure in exchange the chica necessary to paint himself red. Thus as we say, in temperate climates, of a poor man, "he has not enough to clothe himself," you hear the Indians of the Orinoco say, "that man is so poor, that he has not enough to paint half his body." The little trade in chica is carried on chiefly with the tribes of the Lower Orinoco, whose country does not produce the plant which furnishes this much-valued substance. The Caribs and the Ottomacs paint only the head and the hair with chica, but the Salives possess this pigment in sufficient abundance to cover their whole bodies. When the missionaries send on their own account small cargoes of cacao, tobacco, and chiquichiqui* from the Rio Negro to Angostura; they always add some cakes of chica, as being articles of merchandise in great request.

The custom of painting is not equally ancient among all the tribes of the Orinoco. It has increased since the time when the powerful nation of the Caribs made frequent incursions into those countries. The victors and the vanquished were alike naked; and to please the conqueror it was necessary to paint like him, and to assume his colour. The influence of the Caribs has now ceased, and they remain circumscribed between the rivers Carony, Cuyuni, and Paraguamuzi; but the Caribbean fashion of painting the whole body is still preserved. The custom has survived the conquest.

Does the use of the anato and chica derive its origin from the desire of pleasing, and the taste for ornament, so common among the most savage nations? or must we suppose it to be founded on the observation, that these colouring and oily matters with which the skin is plastered, preserve it from the sting of the mosquitos? I have often heard this question discussed in Europe; but in the Missions of the . Orinoco, and wherever, within the tropics, the air is filled with venomous insects, the inquiry would appear absurd. The Carib and the Salive, who are painted red, are not less cruelly tormented by the mosquitos and the zancudos, than the Indians whose bodies are plastered with no colour. The sting of the insect causes

[^255]no swelling in either; and scarcoly ever produces those little pustules which occasion such smarting and itching to Europeans recently arrived. But the native and the White suffer equally from the sting, till the insect has withdrawn its sucker from the skin. After a thousand useless essays, M. Bonpland and myself tried the expedient of rubbing our hands and arms with the fat of the crocodile, and the oil of turtle-eggs, but we never felt the least relief, and were stung as before. I know that the Laplanders boast of oil and fat as the most useful preservatives; but the insects of Scandinavia are not of the same species as those of the Orinoco. The smoke of tobacco drives away our gnats, while it is employed in vain against the zancudos. If the application of fat and astringent* substances preserved the inhabitants of these countries from the torment of insects, as Father Gumilla alleges, why has not the custom of painting the skin become general on these shores? Why do so many naked natives paint only the face, though living in the neighbourhood of those who paint the whole body? $\dagger$

We are struck with the observation, that the Indians of the Orinoco, like the natives of North America, prefer the substances that yield a red colour to every other. Is this predilection. founded on the facility with which the savage procures ochreous earths, or the colouring fecula of anato and of chica? I doubt this much. Indigo grows wild in a great part of equinoctial America. This plant, like so many other leguminous plants, would have furnished the natives abundantly with pigments to colour themselves blue like the ancient Britons. $\ddagger$ Yet we see no American tribe painted with indigo. It appears to me probable, as I have already hinted above, that the preference given by the Americans to the red colour is generally founded on the tendency which nations feel to attribute the idea of beauty to whatever characterises their national physiognomy. Men whose skin is naturally of a brownish red, love a red colour. If

[^256]they be born with a forehead little raised, and the head flat, they endeavour to depress the forehoads of their children. If they be distinguished from other nations by a thin beard, they try to eradicate the few hairs that nature has given them. They think themselves embellished in proportion as they heighten the characteristie marks of their race, or of their national conformation.

We were surprised to see, that, in the camp of Pararnma, the women far advanced in years were more occupied with their ornaments than the youngest women. We saw an Indian female of the nation of the Ottomacs employing two of her daughters in the operation of rubbing her hair with the oil of turtles' eggs, and painting her back with anato and caruto. The ornament consisted of a sort of latticework formed of black lines crossing each other on a red ground. Each little square had a black dot in the centre. It was a work of incredible patience. We returned from a very long herborization, and the painting was not half finished. This research of ornament seems the more singular when we reflect that the figures and marks are not produced by the process of tattooing, but that paintings executed with so much care are effaced,* if the Indian exposes himself imprudently to a heavy shower. There are some nations who paint only to celebrate festivals; others are covered with colour during the whole year: and the latter consider the use of anato as so indispensable, that both men and women would perhaps be less ashamed to present themselves without a guayuco $\dagger$ than destitute of paint. These guayucos of the Orinoco are partly bark of trees, and partly cotton-cloth. Those of the men are broader than those worn by the women, who, the missionaries say, have in general a less lively feeling of modesty. A similar observation was made by Christopher Columbus. May we not attribute this indifference, this want of delicacy in

[^257]women belonging to nations of which the manners are not much depraved, to that rude state of slavery to which the sex is reduced in South America by male injustice and tyranny?

When we speak in Europe of a native of Guiana, we figure to ourselves a man whose head and waist are decorated with the fine feathers of the macaw, the toucan, and the humming-bird. Our painters and sculptors have long since regarded these ornaments as the characteristic marks of an American. We were surprised at not finding in the Chayma Missions, in the encampments of Uruana and of Pararuma (I might almost say on all the shores of the Orinoco and the Cassiquiare) those fine plumes, those feathered aprons, which are so often brought by travellers from Cayenne and Demerara. These tribes for the most part, even those whose intellectual faculties are most expanded, who cultivate alimentary plants, and know how to weave cotton, are altogether as naked,* as poor, and as destitute of ornaments as the natives of New Holland. The excessive heat of the air, the profuse perspiration in which the body is bathed at every hour of the day and a great part of the night, render the use of clothes insupportable. Their objects of ornament, and particularly their plumes of feathers, are reserved for dances and solemn festivals. The plumes worn by the Guipuñavest are the most celebrated; being composed of the fine feathers of manakins and parrots.

The Indians are not always satisfied with one colour uniformly spread; they sometimes imitate, in the most whimsical manner, in painting their skin, the form of European garments. We saw some at Pararuma, who were painted with blue jackets and black buttons. The missionaries related to us that the Guaynaves of the Rio Caura are accustomed to stain themselves red with anato, and to make broad transverse stripes on the body, on which they stick spangles of silvery mica. Seen at a distance, these

[^258]naked men appear to be dressed in laced clothes. If painted nations had been examined with the same attention as those who are clothed, it would have been perceived that the most fertile imagination, and the most mutable caprice, have created the fashions of painting, as well as those of garments.
Painting and tattooing are not restrained, in either the New or the Old World, to one race or one zone only. These ornaments are most common among the Malays and American races; but in the time of the Romans they were also employed by the white race in the north of Europe. As the most picturesque garments and modes of dress are found in the Grecian Archipelago and western Asia, so the type of beauty in painting and tattooing is displayed by the islanders of the Pacific. Some clothed nations still paint their hands, their nails, and their faces. It would seem that painting is then confined to those parts of the body that remain uncovered; and while rouge, which recalls to mind the savage state of man, is disappearing by degrees in Europe, in some towns of the province of Peru the ladies think they embellish their delicate skins by covering them with colouring vegetable matter, starch, white-of-egg, and flour. After having lived a long time among men painted with anato and chica, we are singularly struck with these remains of ancient barbarism retained amidst all the usages of civilization.

The encampment at Pararuma afforded us an opportunity of examining several animals in their natural state, which, till then, we had seen only in the collections of Europe. These little animals form a branch of commerce for the missionaries. They exchange tobacco, the resin called mani, the pigment of chica, gallitos (rock-manakins), orange monkeys, capuchin monkeys, and other species of monkeys in great request on the coast, for cloth, nails, hatchets, fishhooks, and pins. The productions of the Orinoco are bought at a low price from the Indians, who live in dependence on the monks; and these same Indians purchase fishing and gardening implements from the monks at a very high price, with the money they have gained at the egg-harvest. We ourselves bought several animals, which we kept with YOL. II.
ins throughout the rest of our passage on the river, and studied their manners.

The gallitos, or rock-manakins, are sold at Pararuma in pretty little cages made of the footstalks of palm-leares. These birds are infinitely more rare on the banks of the Orinoco, and in the north and west of equinoctial America, than in French Guiana. They have hitherto been found only near the Mission of Encaramada, and in the Raudales or cataracts of Maypures. I say expressly in the cataracts, because the gallitos choose for their habitual dwelling the hollows of the little granitic rocks that cross the Orinoco and form such numerous cascades. We sometimes saw them appear in the morning in the midst of the foam of the river, calling their females, and fighting in the manner of our cocks, folding the double moveable crest that decorates the crown of the head. As the Indians very rarely take the full-grown gallitos, and those males only are valued in Europe, which from the third year have beautiful saffron-coloured plumage, purchasers should be on their guard not to confound young females with young males. Both the male and female gallitos are of an olive-brown; but the pollo, or young male, is distinguishable at the carliest age, by its size and its yellow feet. After the third year the plumage of the males assumes a beautiful saffron tint; but the female remains always of a dull dusky brown colour, with yellow only on the wing-coverts and tips of the wings.* To preserve in our collections the fine tint of the plumage of a male and full-grown rock-manakin, it must not be exposed to the light. This tint grows pale more easy than in the other genera of the passerine order. The young males, as in most other birds, have the plumage or livery of their mother. I am surprised to see that so skilful a naturalist as Le Vaillant + can doabt whether the females always remsin of a dusky olive tint. The Indians of the Raudales all assared me that they had never seen a saffron-coloured female.

Among the monkeys, brought by the Indians to the fair of Pararums, we distinguished several varieties of the sait +

## * Especially the part which ornithologists call the carpus.

+ Oiseaux de Paradis, vol. ii, p. 61.
$\ddagger$ simia capucina, (the capuchin monkey).
belonging to the little groups of creeping monkeys called matchi in the Spanish colonies; marimondes,* or ateles with a red belly; titis, and viunditas. The last two species particolarly attracted our attention, and we purchased them to send to Europe.
The titi of the Orinoco (Simia sciarea), well-known in our collections, is called bititoni by the Maypure Indians. It is very common on the south of the cataracts. Its face is white; and a little spot of bluish-black covers the mouth and the point of the nose. The titis of the most elegant form, and the most beautiful colour (with hair of a golden yellow), come from the banks of the Cassiquiare. Those that are taken on the shores of the Guaviare are large and difficult to tame. No other monkey has so much the phycognomy of a child as the titi; there is the same expression of innocence, the same playful smile, the same rapidity in the transition from joy to sorrow. Its large eyes are instantly filled with tears, when it is seized with fear. It is extreanely fond of insects, particularly of spiders. The sagacity of this little animal is so great, that one of those we brought in our boat to Angostura distinguished perfectly the different plates annexed to Cuvier's 'Tableau élémentaire d'Histoire naturelle.' The engravings of this work are not coloured; yet the titi advanced rapidly its little hand in the hope of catching a grasshopper or a wasp, every time that we showed it the eleventh plate, on which these insects are represented. It remained perfectly indifferent when it was shown engravings of skeletons or heads of mammiferons animals.t When several of these little monkeys, shat up in the same cage, are exposed to the rain, and the habitual temperature of the air sinks suddenly two or three degrees, they twist their tail (which, however, is not prehensile) roand their nock, and intertwine their arms and legs to warm one another. The Indian huntera told as, that

> *. Simina belerebuth.

I I may obearve, that I have never heard of an insanace in which a picture, representing, in the greateat perfoction, hares or deor $\&$ thir natural size, has made the least impreasion even on sporting doges, the intelligence of which appears the most improved. Is there any suthenticated instance of a dog having recognized a full-length picture of

in the forests they often met groups of ten or twelve of these animals, whilst others sent forth lamentable cries, because they wished to enter amid the group to find warmth and shelter. By shooting arrows dipped in weak poison at one of these groups, a great number of young monkeys are taken alive at once. The titi in falling remains clinging to its mother, and if it be not wounded by the fall, it does not quit the shoulder or the neck of the dead animal. Most of those that are found alive in the huts of the Indians have been thus taken from the dead bodies of their mothers. Those that are full grown, when cured of a slight wound, commonly die before they can accustom themselves to a domestic state. The titis are in general delicate and timid little animals. It is very difficult to convey them from the Missions of the Orinoco to the coast of Caracas, or of $\mathrm{Cu}-$ mana. They become melancholy and dejected in proportion as they quit the region of the forests, and enter the Llanos. This change cannot be attributed to the slight elevation of the temperature; it seems rather to depend on a greater intensity of light, a less degree of humidity, and some chemical property of the air of the coast.

The saimiri, or titi of the Orinoco, the atele, the sajou, and other quadrumanous animals long known in Europe, form a striking contrast, both in their gait and habits, with the macavahu, called by the missionaries viudita, or 'widow in mourning.' The hair of this little animal is soft, glossy, and of a fine black. Its face is covered with a mask of a square form and a whitish colour tinged with blue. This mask contains the eyes, nose, and mouth. The ears have a rim : they are small, very pretty, and almost bare. The neck of the widow presents in front a white band, an inch broad, and forming a semicircle. The feet, or rather the hinder hands, are black like the rest of the body; but the fore paws are white without, and of a glossy black within. In these marks, or white spots, the missionaries think they recognize the veil, the neckerchief, and the gloves of a widow in mourning. The character of this little monkey, which sits up on its hinder extremities only when eating, is but little indicated in its appearance. It has a wild and timid air; it often refuses the food offered to it, even when tormented by a ravenous appetite. It has little inclination
for the society of other monkeys. The sight of the smallest saimiri puts it to flight. Its eye denotes great vivacity. We have seen it remain whole hours motionless without sleeping, and attentive to everything that was passing around. But this wildness and timidity are merely apparent. The viudita, when alone, and left to itself, becomes furious at the sight of a bird. It then climbs and runs with astonishing rapidity; darts upon its prey like a cat; and kills whatever it can seize. This rare and delicate monkey is found on the right bank of the Orinoco, in the granite mountains which rise behind the Mission of Santa Barbara. It inhabits also the banks of the Guaviare, near San Fernando de Atabapo.

The viudita accompanied us on our whole voyage on the Cassiquiare and the Rio Negro, passing the cataracts twice. In studying the manners of animals, it is a great advantage to observe them during several months in the open air, and not in houses, where they lose all their natural vivacity.

The new canoe intended for us was, like all Indian boats, a trunk of a tree hollowed out partly by the hatchet and partly by fire. It was forty feet long, and three broad. Three persons could not sit in it side by side. These canoes are so crank, and they require, from their instability, a cargo so equally distributed, that when you want to rise for an instant, you must warn the rowers to lean to the opposite side. Without this precaution the water would necessarily enter the side pressed down. It is difficult to form an idea of the inconveniences that are suffered in such wretched vessels.

The missionary from the cataracts made the preparations for our voyage with greater energy than we wished. Lest there might not be a sufficient number of the Maco and Guahibe Indians, who are acquainted with the labyrinth of small channels and cascades of which the Raudales or cataracts are composed, two Indians were, during the night, placed in the cepo-a sort of stocks in which they were made to lie with their legs between two pieces of wood, notched and fastened together by a chain with a padlock. Early in the morning we were awakened by the cries of a young man, mercilessly beaten with a whip of manati skin. His name was Zerepe, a very intelligent young Indian, who proved

highly useful to us in the sequel, but who now refused to accompany us. He was born in the Mission of Atures; but his father was a Maco, and his mother a native of the nation of the Maypures. He had returned to the woods (al monte), and having lived some years with the unsubdued Indians, he had thus acquired the knowledge of several languages, and the missionary employed him as an interpreter. We obtained with difficulty the pardon of this young man. "Without these acts of severity," we were told, "you would want for everything. The Indians of the Raudales and the Upper Orinoco are a stronger and more laborious race than the inhabitants of the Lower Orinoco. They know that they are much sought after at Angostura If left to their own will, they would all go down the river to sell their productions, and live in full liberty among the whites. The Missions would be totally deserted."

These reasons, I confess, appeared to me more specious than sound. Man, in order to enjoy the advantages of a social state, must no doubt sacrifice a part of his natural rights, and his original independence; but, if the sacrifice imposed on him be not compensated by the benefits of civilization, the savage, wise in his simplicity, retains the wish of returning to the forests that gave him birth. It is because the Indian of the woods is treated like a person in a state of villanage in the greater part of the Missions, because he enjoys not the fruit of his labours, that the Christian establishments on the Orinoco remain deserts. A government founded on the ruins of the liberty of the natives extinguishes the intellectual faculties, or stops their progress.

To way that the savage, like the child, can be governed only by force, is merely to establish false analogies. The Indians of the Orinoco have something infantine in the expression of their joy, and the quick succession of their emotions, but they are not great children; they are as little so as the poor labourers in the east of Europe, whom the barbarism of our feudal institutions has held in the rudest state. To consider the employment of force as the first and sole means of the civilization of the savage, is a principle as far from being true in the education of nations as in the education of youth. Whatever may be the state of weakness or degradation in our species, no faculty is entirely
amihilated. The human understanding exhibita only different degrees of strength and development. The savage, like the child, compares the present with the past; he directs his actions, not according to blind instinct, but motives of interest. Reason can everywhere enlighten reason; and its progress will be retarded in proportion as the men who are called upon to bring up youth, or govern nations, substitute constraint and force for that moral influence which can alone unfold the rising faculties, calm the irritated passions, and give stability to social order.

We could not set sail before ten on the morning of the 10th. To gain something in breadth in our new canoe, a sort of lattice-work had been constructed on the stern with branches of trees, that extended on each side beyond the gunwale. Unfortunately, the toldo or roof of leaves, that covered this lattice-work, was so low that we were obliged to lie down, without seeing anything, or, if seated, to sit nearly double. The necessity of carrying the canoe across the rapids, and even from one river to another; and the fear of giving too much hold to the wind, by making the toldo higher, render this construction necessary for vessels that go up towards the Rio Negro. The toldo was intended to cover four persons, lying on the deck or lattice-work of brush-wood; but our legs reached far beyond it, and when it rained half our bodies were wet. Our couches consisted of ox-hides or tiger-skins, spread upon branches of trees, which were painfully felt through so thin a covering. The fore part of the boat was filled with Indian rowers, furnished with paddles, three feet long, in the form of spoons. They were all naked, seated two by two, and they kept time in rowing with a surprising uniformity, singing songs of a sad and monotonous character. The small cages containing our birds and our monkeys, the number of which augmented as we advanced, were hung some to the toldo and others to the bow of the boat. This was our travelling -menagerie. Notwithstanding the frequent losses occasioned by accidents, and above all by the fatal effects of exposure to the sun, we had fourteen of these little animals alive at our return from the Cassiquiare. Naturalists, who wish to collect and bring living animals to Europe, might canse boats to be constructed expressly for this purpose at Angos-
tura, or at Grand Para, the two capitals situated on the banks of the Orinoco and the Amazon, the fore-deck of which boats might be fitted up with two rows of cages sheltered from the rays of the sun. Every night, when we established our watch, our collection of animals and our instruments occupied the centre; around these were placed first our hammocks, then the hammocks of the Indians; and on the outside were the fires which are thought indispensable against the attacks of the jaguar. About sunrise the monkeys in our cages answered the cries of the monkeys of the forest. These communications between animals of the same species sympathizing with one another, though unseen, one party enjoying that liberty which the other regrets, have something melancholy and affecting.

In a canoe not three feet wide, and so incumbered, there remained no other place for the dried plants, trunks, a sextant, a dipping-needle, and the meteorological instruments, than the space below the lattice-work of branches, on which we were compelled to remain stretched the greater part of the day. If we wished to take the least object out of a trunk, or to use an instrument, it was necessary to row ashore and land. To these inconveniences were joined the torment of the mosquitos which swarmed under the toldo, and the heat radiated from the leaves of the palmtrees, the upper surface of which was continually exposed to the solar rays. We attempted every instant, but always without success, to amend our situation. While one of us hid himself under a sheet to ward off the insects, the other insisted on having green wood lighted beneath the toldo, in the hope of driving away the mosquitos by the smoke. The painful sensations of the eyes, and the increase of heat, already stiffing, rendered both these contrivances alike impracticable. With some gaiety of temper, with feelings of mutual good-will, and with a vivid taste for the majestic grandeur of these vast valleys of rivers, travellers easily support evils that become habitual,

Our Indians showed us, on the right bank of the river, the place which was formerly the site of the Mission of Pararuma, founded by the Jesuits about the year 1733. The mortality occasioned by the small-pox among the Salive Indians was the principal cause of the dissolution of the
mission. The few inhabitants who survived this cruel epidemic, removed to the village of Carichana. It was at Pararuma, that, according to the testimony of Father Roman, hail was seen to fall during a great storm, about the middle of the last century. This is almost the only instance of it I know in a plain that is nearly on a level with the sea; for hail falls generally, between the tropics, only at three hundred toises of elevation. If it form at an equal height over plains and table-lands, we must suppose that it melts as it falls, in passing through the lowest strata of the atmosphere, the mean temperature of which is from $27.5^{\circ}$ to $24^{\circ}$ of the centigrade thermometer. I acknowledge it is very difficult to explain, in the present state of meteorology, why it hails at Philadelphia, at Rome, and at Montpelier, during the hottest months, the mean temperature of which attains $25^{\circ}$ or $26^{\circ}$; while the same phenomenon is not observed at Cumana, at La Guayra, and in general, in the equatorial plains. In the United States, and in the south of Europe, the heat of the plains (from $40^{\circ}$ to $43^{\circ}$ latitude) is nearly the same as within the tropics; and according to my researches the decrement of caloric equally varies but little. If then the absence of hail within the torrid zone, at the level of the sea, be produced by the melting of the hailstones in crossing the lower strata of the air, we must suppose that these hail-stones, at the moment of their formation, are larger in the temperate than in the torrid zone. We yet know so little of the conditions under which water congeals in a stormy cloud in our climates, that we cannot judge whether the same conditions be fulfilled on the equator above the plains. The clouds in which we hear the rattling of the hailstones against one another before they fall, and which move horizontally, have always appeared to me of little elevation; and at these small heights we may conceive that extraordinary refrigerations are caused by the dilatation of the ascending air, of which the capacity for caloric augments; by currents of cold air coming from a higher latitude, and above all, according to M. Gay Lussac, by the radiation from the upper surface of the clouds. I shall have occasion to return to this subject when speaking of the different forms under which hail and hoar-frost appear on the Andes, at two thousand and two thousand six hun-
dred toises of height; and when examining the question whether we may consider the stratam of clouds that envelops the mountains as a horizontal continuation of the stratum which we see immediately above us in the plains.

The Orinoco, full of islands, begins to divide itself into several branches, of which the most western remain dry during the months of January and February. The total breadth of the river exceeds two thousand five handred or three thousand toises. We perceived to the East, opposite the island of Javanavo, the mouth of the Caño Aujacoa. Between this Caño and the Rio Paruasi or Paruati, the country becomes more and more woody. A solitary rock, of extremely picturesque aspect, rises in the midst of a forest of palm-trees, not far from the Orinoco. It is a pillar of granite, a prismatic mass, the bare and steep sides of which attain nearly two hundred feet in height. Its point, which overtops the highest treen of the forest, is terminated by a shelf of rock with a horizontal and smooth surface. Other trees crown this summit, which the missionaries call the peak, or Mogote de Cocuyza. This monnment of nature, in its simple grandeur recalls to mind the Cyclopean remains of antiquity. Its strongly-marked outlines, and the group of trees and shrubs by which it is crowned, stand out from the azure of the sky. It seems a forest rising above a forest.

Further on, near the mouth of the Paruasi, the Orinoco narrows. On the east is perceived a mountain with a bare top, projecting like a promontory. It is nearly three hundred feet high, and served as a fortress for the Jesuits. They had constructed there a small fort, with three batteries of cannon, and it was constantly occupied by a military detachment. We saw the cannon dismounted, and halfburied in the sand, at Carichana and at Atures. This fort of the Jesuits has been destroyed since the dissolution of their society; but the place is still called El Castillo. I find it set down, in a manuscript map, lately completed at Caraoms by a member of the secular clergy, under the denomination of "Trinchera del despotismo monacal."*

The garrison which the Jesuits maintained on this rock, was not intended merely to protect the Missions against

[^259]the incursions of the Caxibs: it was employed also in an offensive war, or, as they say here, in the conquest of souls (conquista de almas). The soldiers, excited by the allurement of gain, made military incursions (entradas) into tho lands of the independent Indians. They killed all those who dared to make any resistance, burnt their huts, destroyed their plantations, and carried away the women, children, and old men, as prisoners. These prisoners wero divided among the Missions of the Meta, the Rio Negra, and the Upper Orinoco. The most distant places were chosen, that they might not be tempted to return to their native country. This violent manner of conquering souls, though prohibited by the Spanish laws, was tolerated by the civil governors, and vaunted by the superiors of the society; as beneficial to religion, and the aggrandizement of the Missions. "The voice of the Gospel is heard only," said a Jesuit of the Orinoco, very candidly, in the 'Cartas Edifiantes,' "where the Indians have heard also the sound of fire-arms (el eco de la polvora). Mildness is a very slow measure. By chastising the natives, we facilitate their conversion." These principles, which degrade humanity, were certainly not common to all the members of a society which, in the New World, and wherever education has remained exclusively in the hands of monks, has rendered service to letters and civilization. But the entradas, the spiritual con quésts with the assistance of bayonets, was an inherent vice in a system, that tended to the rapid aggrandizement of the Missions. It is pleasing to find that the same system is not followed by the Franciscan, Dominican, and Augustinian monks who now govern a vast portion of South America; and who, by the mildness or harshness of their manners, exert a powerful influence over the fate of so many thousands of natives. Military incursions are almost entirely abolished; and when they do take place, they are disavowed by the supariors of the orders. We will not decide at present, whether this amelioration of the monachal system be owing to want of activity and cold indolence; or whether it must be attributed, as we would wish to believe, to the progress of knowledge, and to feelings more elevated, and more conformable to the true spirit of Christianity.

Beyond the mouth of the Rio Paruasi, the Orinoco again
narrows. Full of little islands and masses of granite rock, it presents rapids, or small cascades (remolinos), which at first sight may alarm the traveller by the continual eddies of the water, but which at no season of the year are dangerous for boats. A range of shoals, that crosses almost the whole river, bears the name of the Raudal de Marimara. We passed it without difficulty by a narrow channel, in which the water seems to boil up as it issues out impetuously* below the Piedra de Marimara, a compact mass of granite eighty feet high, and three hundred feet in circumference, without fissures, or any trace of stratification. The river penetrates far into the land, and forms spacious bays in the rocks. One of these bays, inclosed between two promontories destitute of vegetation, is called the Port of Carichana. $\dagger$ The spot has a very wild aspect. In the evening the rocky coasts project their vast shadows over the surface of the river. The waters appear black from reflecting the image of these granitic masses, which, in the colour of their external surface, sometimes resemble coal, and sometimes lead-ore. We passed the night in the small village of Carichana, where we were received at the priest's house, or convento. It was nearly a fortnight since we had slept under a roof.

To avoid the effects of the inundations, often so fatal to health, the Mission of Carichana has been established at three quarters of a league from the river. The Indians in this Mission are of the nation of the Salives, and they have a disagreeable and nasal pronunciation. Their language, of which the Jesuit Anisson has composed a grammar still in manuscript, is, with the Caribbean, the Tamanac, the Maypure, the Ottomac, the Guahive, and the Jaruro, one of the mother-tongues most general on the Orinoco. Father Gili thinks that the Ature, the Piraoa, and the Quaqua or Mapoye, are only dialects of the Salive. My journey was much too rapid to enable me to judge of the accuracy of this opinion; but we shall soon see that, in the village of Ature, celebrated on account of its situation near the great cataracts, neither the Salive nor the Ature is now spoken, but the language of the Maypures. In the Salive of Cari-

* These places are called chorreras in the Spanish colonies.
$\dagger$ Piedra y puerto de Carichana.
chans, man is called cocco; woman, gnacu; water, cagua; fire, eyussa; the earth, seke; the sky, mumeseke (earth on high); the jaguar, impii; the crocodile, cuipoo; maize, giomu; the plaintain, paratuna; cassava, peibe. I may here mention one of those descriptive compounds that seem to characterise the infancy of language, though they are retained in some very perfect idioms.* Thus, as in the Biscayan, thunder is called 'the noise of the cloud (odotsa);' the sun bears the name, in the Salive dialect, of mume-sekecocco, 'the man (cocco) of the earth (seke) above (mume).'

The most ancient abode of the Salive nation appears to have been on the western banks of the Orinoco, between the Rio Vichada $\dagger$ and the Guaviare, and also between the Meta and the Rio Paute. Salives are now found not only at Carichana, but in the Missions of the province of Casanre, at Cabapuna, Guanapalo, Cabiuna, and Macuco. They are a social, mild, almost timid people; and more easy, I will not say to civilize, but to subdue, than the other tribes on the Orinoco. To escape from the dominion of the Caribs, the Salives willingly joined the first Missions of the Jesuits. Accordingly these fathers everywhere in their writings praise the docility and intelligence of that people. The Salives have a great taste for music : in the most remote times they had trumpets of baked earth, four or five feet long, with several large globular cavities communicating with one another by narrow pipes. These trumpets send forth most dismal sounds. The Jesuits have cultivated with success the natural taste of the Salives for instrumental music; and even since the destruction of the society, the missionaries of Rio Meta have continued at San Miguel de Macuco a fine church choir, and musical instruction for the Indian youth. Very lately a traveller was surprised to see the natives playing on the violin, the violoncello, the triangle, the guitar, and the flute.

We found among these Salive Indians, at Carichana, a white woman, the sister of a Jesuit of New Grenada. It is difficult to define the satisfaction that is felt when, in the midst of nations of whose language we are ignorant, we meet with a being with whom we can converse without an

* See vol. i, p. 326.
† The Salive mission, on the Rio Vichada, was destroyed by the Caribs.
isterpreter. Every mission has at least two interpreters (lenguarazes). They are Indians, a little less stupid than the rest, through whose medium the missionaries of the Orinoco, who now very rarely give themselves the trouble of studying the idioms of the country, communicate with the neophytes. These interpreters attended us in all our herborizations; but they rather understand than speak Castilian. With their indolent indifference, they answer us by chance, but always with an officions smile, "Yes, Father; no, Father," to every question addressed to them.

The vexation that arises from such a style of conversation continued for months may easily be conceived, when you wish to be enlightened upon objects in which you take the most lively interest. We were often forced to employ several interpreters at a time, and several successive translators, in order to communicate with the natives.*
"After leaving my Mission," said the good monk of Uruana, "you will travel like mutes." This prediction was nearly accomplished; and, not to lose the advantage we might derive from intercourse even with the rudest Indians, we sometimes preferred the language of signs. When a a native perceives that you will not employ an interpreter; when you interrogate him direetly, showing him the objects; he rouses himself from his habitual apathy, and manifests an extraordinary capacity to make himself comprehended. He raries his signs, pronounces his words slowly, and repeats them without being desired. The consequence conferred upon him, in suffering yourself to be instracted by him, flatters his self-love. This facility in making himself comprehended is particularly remarkable in the independent Indian. It cannot be doubled that direct intercourse with the natives is more instructive and more certain than the communication by interpreters, provided the questions be

* To form a just idea of the perplexity of these communications by forpretere, we may recollect that, in the expedition of Lewis and Clarke to the river Columbia, in order to converse with the Chopunnish Indiass, Captain Lewis addressed one of his men in English; that man translated the question into French to Chabonean; Chaboneau translated it to his Indian wife in Minnetaree; the woman translated it into Shoshonee to a prisoner ; and the prisoner translated it into Chopunnish. It may be feared that the ance of the quention was a little altered by theme succercime tranciations.
simplified, and repeated to several individuals undor different forms. The variety of idioms spoken on the banks of the Meta, the Orinoco, the Cassiquiare, and the Rio Negro, is so prodigions, that a traveller, however great may be his talent for languages, can never hope to learn enough to make himself understood along the navigable rivers, from Angostura to the small fort of San Carlos del Rio Negro. In Peru and Quito it is sufficient to know the Quichua, or the Inca language; in Chile, the Araucan; and in Paraguay, the Guarany; in order to be understood by most of the population. But it is different in the Missions of Spanish Gaiana, where nations of various races are mingled in the same village. It is not even sufficient to have learned the Caribee or Carina, the Guamo, the Guahive, the Jaruro, the Ottomac, the Maypure, the Salive, the Marivitan, the Maquiritare, and the Guaica, ten dialects, of which there exist only imperfect grammars, and which have less affinity with each other than the Greek, German, and Persian languages.

The envirens of the Mission of Cerichana appoared to us to be delightful. The little village is situated in one of those plains covered with grass that separate all the links of the granitic mountains, from Encaramada to beyond the Cataracts of Maypures. The line of the forests is seen only in the distance. The horizon is everywhere bounded by mountains, partly wooded and of a dark tint, partly bare, with rocky summits gilded by the beams of the setting sun. What gives a peculiar character to the scenery of this country are banks of rock (láras) nearly destitute of regetation, and often more than eight hundred feet in circumference, yet scarcely rising a few inches above the surounding savannahs. They now make a part of the plain. We ask ourselves with surprise, whether some extraordinary revolutions may have carried away the earth and plants ; or whether the gramite nucleus of our planet shows itself bare, because the germs of life are not yet developed on all its points. The same phenomenon seems to be found also in the desert of Shamo, which separates Mongolia from China. Those banks of solitary rock in the desert are called try. I think they would be real table-lands, if the surrounding plains were stripped of the sand and mould that cover them, and which the waters have accumulated in the lowest places.

On these stony flats of Carichana we observed with interest the rising vegetation in the different degrees of its development. We there found lichens cleaving the rock, and collected in crusts more or less thick; little portions of sand nourishing succulent plants; and lastly layers of black mould deposited in the hollows, formed from the decay of roots and leaves, and shaded by tufts of evergreen shrubs.

At the distance of two or three leagues from the Mission, we find, in these plains intersected by granitic hills, a vegetation no less rich than varied. On comparing the site of Carichana with that of all the villages above the Great Cataracts, we are surprised at the facility with which we traverse the country, without following the banks of the rivers, or being stopped by the thickness of the forests. M. Bonpland made several excursions on horseback, which furnished him with a rich harvest of plants. I shall mention only the paraguatan, a magnificent species of the macrocnemum, the bark of which yields a red dye;* the guaricamo, with a poisonous root; $\dagger$ the Jacaranda obtusifolia; and the serrape, or jape $\ddagger$ of the Salive Indians, which is the Coumarouna of Aublet, so celebrated throughout Terra Firma for its aromatic fruit. This fruit, which at Caracas is placed among linen, as in Europe it is in snuff, under the name of tonca, or Tonquin bean, is regarded as poisonous. It is a false notion, very general in the province of Cumana, that the excellent liqueur fabricated at Martinique owes its peculiar flavour to the jape. In the Missions it is called simaruba; a name that may occasion serious mistakes, the true simaruba being a febrifuge species of the Quassia genus, found in Spanish Guiana only in the valley of Rio Caura, where the Paudacot Indians give it the name of achecchari.

I found the dip of the magnetic needle, in the great square at Carichana, $38.7^{\circ}$ (new division). The intensity of the magnetic action was expressed by two hundred and twentyseven oscillations in ten minutes of time; an increase of force that would seem to indicate some local attraction. Yet the blocks of the granite, blackened by the waters of the Orinoco, have no perceptible action upon the needle.

The river had risen several inches during the day on the

$\ddagger$ Dipterix odorata, Willd. or Baryosma tongo of Gaertner. The jape frnishes Carichana with excellent timber.

10th of April ; this phenomenon surprised the natives so much the more, as the first swellings are almost imperceptible, and are usually followed in the month of April by a fall for some days. The Orinoco was already three feet higher than the level of the lowest waters. The natives showed us on a granite wall the traces of the great rise of the waters of late years. We found them to be forty-two feet high, which is double the mean rise of the Nile. But this measure was taken in a place where the bed of the Orinoco is singularly hemmed in by rocks, and I could only notice the marks shown me by the natives. It may easily be conceived that the effect and the height of the increase differs according to the profile of the river, the nature of the banks more or less elevated, the number of rivers flowing in that collect the pluvial waters, and the length of ground passed over. It is an unquestionable fact that at Carichana, at San Borja, at Atures, and at Maypures, wherever the river has forced its way through the mountains, you see at a hundred, sometimes at a hundred and thirty feet, above the highest present swell of the river, black bands and erosions, that indicate the ancient levels of the waters. Is then this river, which appears to us so grand and so majestic, only the feeble remains of those immense currents of fresh water which heretofore traversed the country at the east of the Andes, like arms of inland seas? What must have been the state of those low countries of Guiana that now undergo the effects of annual inundations? What immense numbers of crocodiles, manatis, and boas must have inhabited these vast spaces of land, converted alternately into marshes of stagnant water, and into barren and fissured plains! The more peaceful world which we inhabit has then succeeded to a world of tumult. The bones of mastodons and American elephants are found dispersed on the table-lands of the Andes. The megatherium inhabited the plains of Uruguay. On digging deep into the ground, in high valleys, where neither palm-trees nor arborescent ferns can grow, strata of coal are discovered, that still show vestiges of gigantic monocotyledonous plants.

There was a remote period then, in which the classes of plants were otherwise distributed, when the animals were larger, and the rivers broader and of greater depth. There

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end those records of nature, that it is in our power to consult. We are ignorant whether the human race, which at the time of the discovery of America scarcely formed a few feeble tribes on the east of the Cordilleras, had already descended into the plains; or whether the ancient tradition of the 'great waters,' which is found among the nations of the Orinoco, the Erevato, and the Caura, belong to other climates, whence it has been propagated to this part of the New Continent.

On the 11th of April, we left Carichana at two in the afternoon, and found the course of the river more and more encumbered by blocks of granite rocks. We passed on the west the Caño Orupe, and then the great rock known by the name of Piedra del Tigre. The river is there so deep, that no bottom can be found with a line of twenty-two fathoms. Towards evening the weather became cloudy and gloomy. The proximity of the storm was marked by squalls alternating with dead calms. The rain was violent, and the roof of foliage, under which we lay, afforded but little shelter. Happily these showers drove away the mosquitos, at least for some time. We found ourselves before the cataract of Cariven, and the impulse of the waters was so strong, that we had great difficulty in gaining the land. We were continually driven back to the middle of the current. At length two Salive Indians, excellent swimmers, leaped into the water, and having drawn the boat to shore by means of a rope, made it fast to the Piedra de Carichana Vieja, a shelf of bare rock, on which we passed the night. The thunder continued to roll during a part of the night; the swell of the river became considerable; and we were several times afraid that our frail bark would be driven from the shore by the impetuosity of the waves.

The granitic rock on which we lay is one of those, where travellers on the Orinoco have heard from time to time, towards sunrise, subterraneous sounds, resembling those of the organ. The missionaries call these stones lactas de musica. 'It is witchcraft (cosa de bruxas),' said our young Indian pilot, who could speak Spanish. We never ourselves heard these mysterious sounds, either at Carichana Vieja, or in the Upper Orinoco; but from information given us by witnesses worthy of belief, the existence of a pheno-
menon that seems to depend on a certain state of the atmosphere, cannot be denied. The shelves of rock are full of very narrow and deep crevices. They are heated during the day to $48^{\circ}$ or $50^{\circ}$. I several times found their temperature at the surface, during the night, at $39^{\circ}$, the surrounding atmosphere being at $28^{\circ}$. It may easily be conceived, that the difference of temperature between the subterranean and the external air attains its maximum about sumrise, or at that moment which is at the same time farthest from the period of the maximum of the heat of the preceding day. May not these organ-like sounds, which are heard when a person lays his ear in contact with the stone, be the effect of a current of air that issues out through the crevices? Does not the impulse of the air against the elastic spangles of mica that intercept the crevices, contribute to modify the sounds? May we not abmit that the ancient inhabitants of Egypt, in passing incessantly up and down the Nile, had made the same observation on some rock of the Thebaid; and that the 'music of the rocks' there led to the jugglery of the priests in the statue of Memnon? Perhaps, when 'the rosyfingered Aurora rendered her son, the glorious Memnon, vocal,' ${ }^{\prime}$ the voice was that of a man hidden beneath the pedestal of the statue; but the observation of the natives of the Orinoco, which we relate, seems to explain in a natural manner what gave rise to the Egyptian belief of a stone that poured forth sounds at sunrise.

Almost at the same period at which I communicated these conjectures to some of the learned of Europe, three French travellers, MM. Jomard, Joilois, and Devilliers, were led to analogous ideas. They heard, at sunrise, in a monument of granite, at the centre of the spot on which stands the palace of Karnak, a noise resembling that of a string breaking. Now this comparison is precisely that which the ancients employed in speaking of the voice of Memnon. The French travellers thought, like me, that the passage of

[^260]rarefied air through the fissures of a sonorous stone might have suggested to the Egyptian priests the invention of the juggleries of the Memnonium.

We left the rock at four in the morning. The missionary had told us that we should have great difficulty in passing the rapids and the mouth of the Meta. The Indians rowed twelve hours and a half without intermission, and during all that time, they took no other nourishment than cassava and plantains. When we consider tise difficulty of overcoming the force of the current, and of passing the cataracts ; when we reflect on the constant employment of the muscular powers during a navigation of two months; we are equally surprised at the constitutional vigour and the abstinence of the Indians of the Orinoco and the Amazon. Amylaceous and saccharine substances, sometimes fish and the fat of turtles' eggs, supply the place of food drawn from the first two classes of the animal kingdom, those of quadrupeds and birds.

We found the bed of the river, to the length of six hundred toises, full of granite rocks. Here is what is called the Raudal de Cariven. We passed through channels that were not five feet broad. Our canoe was sometimes jammed between two blocks of granite. We sought to avoid these passages, into which the waters rushed with a fearful noise; but there is really little danger, in a canoe steered by a good Indian pilot. When the current is too violent to be resisted the rowers leap into the water, and fasten a rope to the point of a rock, to warp the boat along. This manœurre is very tedious; and we sometimes availed ourselves of it, to climb the rocks among which we were entangled. They are of all dimensions, rounded, very black, glossy like lead, and destitute of vegetation. It is an extraordinary phenomenon to see the waters of one of the largest rivers on the globe in some sort disappear. We perceived, even far from the shore, those immense blocks of granite, rising from the ground, and leaning one against another. The intervening channels in the rapids are more than twenty-five fathoms deep; and are the more difficult to be observed, as the rocks are often narrow toward their bases, and form vaults suspended over the surface of the river. 'We perceived no crocodiles in the raudal; these animals seem to shun the noise of cataracts.

From Cabruta to the mouth of the Rio Sinaruco, a distance of nearly two degrees of latitude, the left bank of the Orinoco is entirely uninhabited; but to the west of the Raudal de Cariven an enterprising man, Don Felix Relinchon, had assembled some Jaruro and Ottomac Indians in a small village. It is an attempt at civilization, on which the monks have had no direct influence. It is superfluous to add, that Don Felix lives at open war with the missionaries on the right bank of the Orinoco.

Proceeding up the river we arrived, at nine in the morning, before the mouth of the Meta, opposite the spot where the Mission of Santa Teresa, founded by the Jesuits, was heretofore situated.

Next to the Guaviare, the Meta is the most considerable river that flows into the Orinoco. It may be compared to the Danube, not for the length of its course, but for the volume of its waters. Its mean depth is thirty-six feet, and it sometimes reaches eighty-four. The union of these two rivers presents a very impressive spectacle. Lonely rocks rise on the eastern bank. Blocks of granite, piled upon one another, appear from afar like castles in ruins. Vast sandy shores keep the skirting of the forest at a distance from the river; but we discover amid them, in the horizon, solitary palm-trees, backed by the sky, and crowning the tops of the mountains. We passed two hours on a large rock, standing in the middle of the Orinoco, and called the Piedra de la Paciencia, or the Stone of Patience, because the canoes, in going up, are sometimes detained there two days, to extricate themselves from the whirlpool caused by this rock.
The Rio Meta, which traverses the vast plains of Casanare, and which is navigable as far as the foot of the Andes of New Grenada, will one day be of great political importance to the inhabitants of Guiana and Venezuela. From the Golfo Triste and the Boca del Drago a small fleet may go up the Orinoco and the Meta to within fifteen or twenty leagues of Santa Fé de Bogotá. The flour of New Grenada may be conveyed the same way. The Meta is like a canal of communication between countries placed in the same latitude, but differing in their productions as much as France and Senegal. The Meta has its source in the union
of two rivers which descend from the paramos of Chingasa and Suma Paz. The first is the Rio Negro, which, lower down, receives the Pachaquiaro; the second is the Rio de Aguas Blancas, or Umadea. The junction takes place near the port of Marayal. It is only eight or ten leagues from the Passo de la Cabulla, where you quit the Rio Negro, to the capital of Santa Fé. From the villages of Xiramena and Cabullaro to those of Guanapalo and Santa Rosalia de Cabapuna, a distance of sixty leagues, the banks of the Meta are more inhabited than those of the Orinoco. We find in this space fourteen Christian settlements, in part very populous; but from the mouths of the rivers Pauto and Casanare, for a space of more than fifty leagues, the Meta is infeated by the Guahibos, a race of savages.*

The navigation of this river was much more active in the time of the Jesuits, and particularly during the expedition of Iturriaga, in 1756, than it is at present. Missionaries of the same order then governed the banks of the Meta and of the Orinoco. The villages of Macuco, Zurimena, and Casimena, were founded by the Jesuits, as well as those of Cruana, Encaramada, and Carichana.

These Fathers had conceived the project of forming a series of Missions from the junction of the Casanare with the Meta to that of the Meta with the Orinoco. A narrow zone of cultivated land would have crossed the vast steppes that separate the forests of Guiana from the Andes of New Grenada:

At the period of the "harvest of turtles' eggs," not only the flour of Santa Fé descended the river, but the salt of Chita, $\dagger$ the cotton cloth of San Gil, and the printed counterpanes of Socorro. To give some security to the little traders who devoted themselves to this inland commerce, attacks were made from time to time from the castillo or fort of Carichana, on the Guahibos.

To keep these Guahibos in awe, the Capuchin missionaries, who succeeded the Jesuits in the government of the

[^261]Missions of the Orinoco, formed the project of founding a city at the mouth of the Meta, under the name of the Villa de San Carlos. Indolence, and the dread of tertian fevers, have prevented the execution of this project; and all that has ever existed of the city of San Carlos, is a coat of arms painted on fine parchment, with an enormous cross erected on the bank of the Meta. The Guahibos, who, it is said, are some thousands in number, have become so insolent, that, at the time of our passage by Carichana, they sent word to the missionary that they would come on rafts, and burn his village. These rafts (valzas), which we had an opportunity of seeing, are scarcely three feet broad, and twelve feet long. They carry only two or three Indians; but fifteen or sixteen of these rafts are fastened to each other with the stems of the paullinia, the dolichos, and other creeping plants. It is difficult to conceive how these small craft remain tied together in passing the rapids. Many fugitives from the villages of the Casanare and the Apure have joined the Guahibos, and taught them the practice of eating beef, and preparing hides. The farms of San Vicente, Rubio, and San Antonio, have lost great numbers of their horned cattle by the incursions of the Indians, who also prevent travellers, as far as the junction of the Casanare, from sleeping on the shore in going up the Meta. It often happens, while the waters are low, that the traders of New Grenada, some of whom still visit the encampment of Pararuma, are killed by the poisoned arrows of the Guahibos.
From the mouth of the Meta, the Orinoco appeared to us to be freer of shoals and rocks. We navigated in a channel five handred toises broad. The Indians remained rowing in the boat, without towing or pushing it forward with their arms, and wearying us with their wild cries. We passed the Caños of Uita and Endava on the west. It was night when we reached the Raudal de Tabaje. The Indians would not hazard passing the cataract; and we slept on a very incommodious spot, on the shelf of a rock, with a slope of more than eighteen degrees, and of which the crevices sheltered a swarm of bats. We heard the cries of the jaguar very near us during the whole night. They were answered by our great dog in lengthened howlings. I waited the appearance of the stars in vain: the :aky was
exceedingly black; and the hoarse sounds of the cascades of the Orinoco mingled with the rolling of the distant thunder.

Early in the morning of the 13th April we passed the rapids of Tabaje, and again disembarked. Father Zea, who accompanied us, desired to perform mass in the new Mission of San Borja, established two years before. We there found six houses inhabited by uncatechised Guahibos. They differ in nothing from the wild Indians. Their eyes, which are large and black, have more vivacity than those of the Indians who inhabit the ancient missions. We in vain offered them brandy; they would not even taste it. The faces of all the young girls were marked with round black spots; like the patches by which the ladies of Europe formerly imagined they set off the whiteness of their skins. The bodies of the Guahibos were not painted. Several of them had beards, of which they seemed proud; and, taking us by the chin, showed us by signs, that they were made like us. Their shape was in general slender. I was again struck, as I had been among the Salives and the Macos, with the little uniformity of features to be found among the Indians of the Orinoco. Their look is sad and gloomy; but neither stern nor ferocious. Without having any notion of the practices of the Christian religion, they behaved with the utmost decency at church. 'The Indians love to exhibit themselves; and will submit temporarily to any restraint or subjection, provided they are sure of drawing attention. At the moment of the consecration, they made signs to one another, to indicate beforehand that the priest was going to raise the ${ }^{*}$ chalice to his lips. With the exception of this gesture, they remained motionless and in imperturbable apathy.

The interest with which we examined these poor savages became perhaps the cause of the destruction of the mission. Some among them, who preferred a wandering life to the labours of agriculture, persuaded the rest to return to the plains of the Meta. They told them, "that the white men would come back to San Borja, to take them away in the boats, and sell them as poitos, or slaves, at Angostura." The Guahibos awaited the news of our return from the Rio Negro by the Cassiquiare; and when they heard that we were arrived at the first great cataract, that of Atures, they all deserted, and fled to the savannahs that border the

Orinoco on the west. The Jesuit Fathers had already formed a mission on this spot, and bearing the same name. No tribe is more difficult to fix to the soil than the Guahibos. They would rather feed on stale fish, scolopendras, and worms, than cultivate a little spot of ground. The other Indians say, that "a Guahibo eats everything that exists, both on and under the ground."

In ascending the Orinoco more to the south, the heat, far from increasing, became more bearable. The air in the day was at $26^{\circ}$ or $27.5^{\circ}$; and at night, at $23.7^{\circ}$. The water of the Orinoco retained its babitual temperature of $27 \cdot 7^{\circ}$. The torment of the mosquitos augmented severely, notwithstanding the decrease of heat. We never suffered so much from them as at San Borja. We could neither speak nor uncover our faces without having our mouths and noses filled with insects. We were surprised not to find the thermometer at $35^{\circ}$ or $36^{\circ}$; the extreme irritation of the skin made us believe that the air was scorching. We passed the night on the beach of Guaripo. The fear of the little caribe fish prevented us from bathing. The crocodiles we had met with this day were all of an extraordinary size, from twenty, two to twenty-four feet.

Our sufferings from the zancudos made us depart at five o'clock on the morning of the 14th. There are fewer insects in the strata of air lying immediately on the river, than near the edge of the forests. We stopped to breakfast at the island of Guachaco, or Vachaco, where the granite is immediately covered by a formation of sandstone, or conglomerate. This sandstone contains fragments of quartz, and even of feldspar, cemented by indurated clay. It exhibits little veins of brown iron-ore, which separate in laminæ, or plates, of one line in thickness. •We had already found these plates on the shores between Encaramada and Baraguan, where the missionaries had sometimes taken them for an ore of gold, and sometimes for tin. It is probable, that this secondary formation occupied formerly a larger space. Having passed the mouth of the Rio Parueni, beyond which the Maco Indians dwell, we spent the night on the island of Panumana. I could with difficulty take the altitudes of Canopus, in order to fix the longitude of the point, near which the river suddenly turns towards the west. The
island of Panumana is rich in plants. We there again found those shelves of bare rock, those tufts of melastomas, those thickets of small shrubs, the blended scenery of which had charmed us in the plains of Carichana. The mountains of the Great Cataracts bounded the horizon towards the south-east. In proportion as we advanced, the shores of the Orinoco exhibited a more imposing and picturesque aspect.

## Chapter XX.

The Month of the Rio Anaveni.-Peak of Uniana.-Mission of Atures. -Cataract, or Raudal of Mapara.-Islets of Surupamana and Uirapuri.
The river of the Orinoco, in running from south to north, is crossed by a chain of granitic mountains. Twice confined in its course, it turbulently breaks on the rocks, that form steps and transverse dykes. Nothing can be grander than the aspect of this spot. Neither the fall of the Tequendama, near Santa Fé de Bogotá, nor the magnificent scenes of the Cordilleras, could weaken the impression produced upon my mind by the first view of the rapids of Atures and of Maypures. When the spectator is so stationed that the eye can at once take in the long succession of cataracts, the immense sheet of foam and vapours illumined by the rays of the setting sun, the whole river seems as it were suspended over its bed.

Scenes so astonishing must for ages have fixed the attention of the inhabitants of the New World. When Diego de Todaz, Alfonzo de Herrera, and the intrepid Raleigh, anchored at the mouth of the Orinoco, they were informed by the Indians of the Great Cataracts, which they themselves had never visited, and which they even confounded with cascades farther to the east. Whatever obstacles the force of vegetation under the torrid zone may throw in the way of intercourse among nations, all that relates to the course of great rivers acquires a celebrity which extends to vast distances. The Orinoco, the Amazon, and the Uruguay, traverse, like inland arms of seas, in different direotions, a land covered with forests, and inhabited by tribea,
part of whom are cannibals. It is not yet two hundred years since civilization and the light of a more humane religion have pursued their way along the banks of these ancient canals traced by the hand of nature; long, however, before the introduction of agriculture, before communications for the purposes of barter were established among these scattered and often hostile tribes, the knowledge of extraordinary phenomena, of falls of water, of volcanic fires, and of snows resisting all the ardent heat of summer, was propagated by a thousand fortuitous circumstances. Three hundred leagues from the coast, in the centre of South America, among nations whose excursions do not extend to three days' journey, we find 'an idea of the ocean, and words that denote a mass of salt water extending as far as the eye can discern. Various events, which repeatedly occur in savage life, contribute to enlarge these conceptions. In consequence of the petty wars between neighbouring tribes, a prisoner is brought into a strange country, and treated as a poito or mero, that is to say, as a slave. After being often sold, he is dragged to new wars, escapes, and returns home; he relates what he has seen, and what he has heard from those whose tongue he has been compelled to learn. As on discovering a coast, we hear of great inland animals, so, on entering the valley of a vast river, we are surprised to find that savages, who are strangers to navigation, have acquired a knowledge of distant things. In the infant state of society, the exchange of ideas precedes, to a certain point, the exchange of productions.

The two great cataracts of the Orinoco, the celebrity of which is so far-spread and so ancient, are formed by the passage of the river across the mountains of Parima. They are called by the natives Mapara and Quittuna; but the missionaries have substituted for these names those of Atures and Maypures, after the names of the tribes which were first assembled together in the nearest villages. On the coast of Caracas, the two Great Cataracts are denoted by the simple appellation of the two Raudales, or rapids; a denomination which implies that the other falls of water, even the rapids of Camiseta and of Carichana, are not considered as worthy of attention when compared with the cataracts of Atures and Maypures.

These last, situated between five and six degrees of north latitude, and a hundred leagues west of the Cordilleras of New Grenada, in the meridian of Porto Cabello, are only twelve leagues distant from each other. It is surprising that their existence was not known to D'Anville, who, in his fine map of South America, marks the inconsiderable cascades of Marimara and San Borja, by the names of the rapids of Carichana and Tabaje. The Great Cataracts divide the Christian establishments of Spanish Guiana into two unequal parts. Those situated between the Raudal of Atures and the mouth of the river are called the Missions of the Lower Orinoco; the Missions of the Upper Orinoco comprehend the villages between the Raudal of Maypures and the mountains of Duida. The course of the Lower Orinoco, if we estimate the sinuosities at one-third of the distance in a direct line, is two hundred and sixty nautical leagues: the course of the Upper Orinoco, supposing its sources to be three degrees east of Duida, includes one hundred and sixty-seven leagues.
Beyond the Great Cataracts an unknown land begins. The country is partly mountainous and partly flat, receiving at once the confluents of the Amazon and the Orinoco. From the facility of its communications with the Rio Negro and Grand Para, it appears to belong still more to Brazil than to the Spanish colonies. None of the missionaries who have described the Orinoco before me, neither Father Gumilla, Gili, nor Caulin, had passed the Raudal of Maypures. We found but three Christian establishments above the Great Cataracts, along the shores of the Orinoco, in an extent of more than a hundred leagues; and these three establishments contained scarcely six or eight white persons, that is to say, persons of European race. We cannot be surprised that such a desert region should have been at all times the land of fable and fairy visions. There, according to the statements of certain missionaries, are found races of men, some of whom have an eye in the centre of the forehead, whilst others have dogs' heads, and mouths below their stomachs. There they pretend to have found all that the ancients relate of the Garamantes, of the Arimaspes, and of the Hyperboreans. It would be an error to suppose that these simple and often rustic missionaries
had themselves invented all these exaggerated fictions; they derived them in great part from the recitals of the Indians. A fondness for narration prevails in the Missions, as it does at sea, in the East, and in every place where the mind seeks amusement. A missionary, from his vocation, is not inclined to scepticism; he imprints on his memory what the natives have so often repeated to him; and, when returned to Europe, and restored to the civilized world, he finds a pleasure in creating astonishment by a recital of facts which he thinks he has collected, and by an animated description of remote things. These stories, which the Spanish colonists call 'tales of travellers and of monks' (cuentos de viageros y frailes), increase in improbability in proportion as you increase your distance from the forests of the Orinoco, and approach the coasts inhabited by the whites. When, at Cumana, Nueva Barcelona, and other seaports which have frequent communication with the Missions, you betray any sign of incredulity, you are reduced to silence by these few words: "The fathers have seen it, but far above the Great Cataracts (mas arriba de los Raudales)."

On the 15th of April, we left the island of Panumana at four in the morning, two hours before sunrise. The sky was in great part obscured, and lightnings flashed over dense clouds at more than forty degrees of elevation. We were surprised at not hearing thunder; but possibly this was owing to the prodigious height of the storm? It appears to us, that in Europe the electric flashes without thunder, vaguely called heat-lightning, are seen generally nearer the horizon. Under a cloudy sky, that sent back the radiant caloric of the soil, the heat was stifling; not a breath of wind agitated the foliage of the trees. The jaguars, as usual, had crossed the arm of the Orinoco by which we were separated from the shore, and we heard their cries extremely near. During the night the Indians had advised us to quit our station in the open air, and retire to a deserted hut belonging to the conucos of the inhabitants of Atures. They had taken care to barricade the opening with planks, a precaution which seemed to us superfluous; but near the Cataracts tigers are very numerous, and two years before, in these very conucos of Panumana, an Indian returning to
his hut, towards the close of the rainy season, found a tigress settled in it with her two young. These animals had inhabited the dwelling for several months; they were dislodged from it with difficulty, and it was only after an obstinate combat that the former master regained possession of his dwelling. The jaguars are fond of retiring to deserted ruins, and I believe it is more prodent in general for a solitary traveller to encamp in the open air, between two fires, than to seek shelter in uninhabited huts.

On quitting the island of Panumana, we perceived on the western bank of the river the fires of an encampment of Guahibo savages. The missionary who accompanied us caused a few musket-shots to be fired in the air, which he said would intimidate them, and shew that we were in a state to defend ourselves: The savages most likely had no canoes, and were not desirous of troubling us in the middle of the river. We passed at sunrise the mouth of the Rio Anaveni, which descends from the eastern mountains. On its banks, now deserted, Father Olmos had established, in the time of the Jesuits, a small village of Japuins or Jaruros. The heat was so excessive that we rested a long time in a woody spot, to fish with a hook and line, and it was not without some trouble that we carried away all the fish we had caught. We did not arrive till very late at the foot of the Great Cataract, in a bay called the lover harbour (puertr) de abaxo); and we followed, not without difficalty, in a dark night, the narrow path that leads to the Mission of Atures, a league distant from the river. We crossed a plain covered with large blocks of granite.

The little village of San Juan Nepomuceno de los Atures was founded by the Jesuit Francisco Gonzales, in 1748. In going up the river this is the last of the Christian missions that owe their origin to the order of St. Ignatius. The more southern establishments, those of Atabapo, of Cassiquiare, and of Rio Negro, were formed by the fathers of the Observance of St. Francis. The Orinoco appears to have flowed heretofore where the village of Atures now stands, and the flat savannah that surrounds the village no doubt formed part of the river. I saw to the east of the mission a succession of rocks, which seemed to have been the ancient shore of the Orinoco. In the lapse of ages the
river has been impelled westward, in consequence of the accumulations of earth, which occur more frequently on the side of the eastern mountains, that are furrowed by torrents. The cataract bears the name of Mapara,* as we have mentioned above; while the name of the village is derived from that of the nation of Atures, now believed to be extinct. I find on the maps of the seventeenth century, Island and Cataract of Athule; which is the word Atures written according to the pronunciation of the Tamanacs, who confound, like so many other people, the consonants $l$ and $r$. This mountainous region was so little known in Europe, even in the middle of the eighteenth century, that D'Anville, in the first edition of his South America, makes a branch issue from the Orinoco, near Salto de los Atures, and fall into the Amazon, to which branch he gives the name of Rio Negro.

Early maps, as well as Father Gumilla's work, place the Mission in latitude $1^{\circ} 30^{\prime}$. Abbe Gili gives it $3^{\circ} 50^{\prime}$. I found, by meridian altitudes of Canopus and $a$ of the Southern Cross, $5^{\circ} 38^{\prime} 4^{\prime \prime}$ for the latitude; and by the chronometer $4^{\mathrm{h}} 41^{\prime} 17^{\prime \prime}$ of longitude west of the meridian of Paris.

We found this small Mission in the most deplorable state: It contained, even at the time of the expedition of Solano, commonly called the 'expedition of the boundaries,' three hundred and twenty Indians. This number had diminished, at the time of our'passage by the Cataracts, to forty-seven; and the missionary assured us that this diminution became from year to year more sensible. He showed us, that in the

* I am ignorant of the etymology of this world, which I believe means only a fall of water. Gili translates into Maypure a small cascade (raudalito) by uccamatisi mapara canacapatirri. Should we not spell this word matpara? mat being a radical of the Maypare tongue, and meaning bad (Hervas, Saygio, N. 29). The radical par (para) is found among American tribes more than five hundred leagues distant from each other, the Caribs, Maypures, Brazilians, and Peruvians, in the words sea, rain, water, lake. We must not confound mapara with mayaja; this last word signifies, in Maypure and Tamanac, the papaw or melontree, no doubt on account of the sweetness of its fruit, for mapa means' in the Maypure, as well as in the Peruvian and Omagua tongues, 'the honey of bees.' The Tamanacs call a cascade, or raudal, in general uatapurutpez the Maypures, uca.
space of thirty-two months only one marriage had been entered in the registers of the parish church. Two others had been contracted by uncatechised natives, and celebrated before the Indian Gobernador. At the first foundation of the Mission, the Atures, Maypures, Meyepures, Abanis, and Quirupas, had been assembled together. Instead of these tribes we found only Guahibos, and a few families of the nation of Macos. The Atures have almost entirely disappeared ; they are no longer known, except by the tombs in the cavern of Ataruipe, which recall to mind the sepulchres of the Guanches at Teneriffe. We learned on the spot, that the Atures, as well as the Quaquas, and the Macos or Piaroas, belong to the great stock of the Salive nations; while the Maypures, the Abanis, the Parenis, and the Guaypuñaves, are of the same race as the Cabres or Caveres, celebrated for their long wars with the Caribs. In this labyrinth of petty nations, divided from one another as the nations of Latium, Asia Minor, and Sogdiana, formerly were, we can trace no general relations but by following the analogy of tongues. These are the only monuments that have reached us from the early ages of the world; the only monuments, which, not being fixed to the soil, are at once moveable and lasting, and have as it were traversed time and space. They owe their duration, and the extent they occupy, much less to conquering and polished nations, than to those wandering and half-savage tribes, who, fleeing before a powerful enemy, carried along with them in their extreme wretchedness only their wives, their children, and the languages of their fathers.

Between the latitudes of $4^{\circ}$ and $8^{\circ}$, the Orinoco not only separates the great forest of the Parime from the bare savannahs of the Apure, Meta, and Guaviare, but also forms the boundary between tribes of very different manners. To the westward, over treeless plains, wander the Guahibos, the Chiricoas, and the Guamos; nations, proud of their savage independence, whom it is difficult to fix to the soil, or habituate to regular labour. The Spanish missionaries characterise them well by the name of Indios andantes (errant or vagabond Indians), because they are perpetually moving from place to place. To the east of the Orinoco, between the neighbouring sources of the Caura, Cataniapo,
and Ventuari, live the Macos, the Salives, the Curacicanas, Parecas, and Maquiritares, mild, tranquil tribes, addicted to agriculture, and easily subjected to the discipline of the Missions. The Indian of the plains differs from the Indian of the forests in language as well as manners and mental disposition; both have an idiom abounding in spirited and bold terms; but the language of the former is harsher, more concise, and more impassioned; that of the latter, softer, more diffuse, and fuller of ambiguous expressions.

The Mission of Atures, like most of the Missions of the Orinoco, situated between the mouths of the Apure and the Atabapo, is composed of both the classes of tribes we have just described. We there find the Indians of the forests, and the Indians heretofore nomadic* (Indios monteros and Indios llaneros, or andantes). We visited with the missionary the huts of Macos, whom the Spaniards call Piraoas, and those of the Guahibos. The first indicated more love of order, cleanliness, and ease. The independent Macos (I do not designate them by the name of savages) have their rochelas, or fixed dwellings, two or three days' journey east of Atures, toward the sources of the little river Cataniapo. They are very numerous. Like most of the natives of the woods, they cultivate, not maize, but cassava; and they live in great harmony with the Christian Indians of the mission. The harmony was established and wisely cultivated by the Franciscan monk, Bernardo Zea. This alcalde of the reduced Macos quitted the village of Atures for a few months every year, to live in the plantations which he possessed in the midst of the forests near the hamlet of the independent Macos. In consequence of this peaceful intercourse, many of the Indios monteros came and established themselves some time ago in the mission. They asked eagerly for knives, fishing hooks, and those coloured glass-beads, which, notwithstanding the positive prohibition of the priests, were employed not as necklaces, but as ornaments of the guayuco (perizoma). Having obtained what they sought, they re-

* I employ the word nomadic as synonymous with wandering, and not in its primitive signification. The wandering nations of America (those of the indigenous tribes, it is to be understood) are never shepherds; they live by fishing and hunting, on the fruit of a few trees, the farinaceous pith of palm-trees, \&c.

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turned to the woods, weary of the regulations of the mission. Epidemic fevers, which prevailed with violence at the entrance of the rainy season, contributed greatly to this unexpected flight. In 1799 the mortality was very considerable at Carichana, on the banks of the Meta, and at the Raudal of Atures. The Indian of the forest conceives a horror of the life of the civilized man, when, I will not say any misfortune befalls his family settled in the mission, but merely any disagreeable or unforeseen accident. Natives, who were neophytes, have been known to desert for ever the Christian establishments, on account of a great drought; as if this calamity would not have reached them equally in their plantations, had they remained in their primitive independence.

The fevers which prevail during a great part of the year in the villages of Atures and Maypures, around the two Great Cataraets of the Orinoco, render these spots highly dangerous to European travellers. They are caused by violent heats, in combination with the excessive humidity of the air, bad nutriment, and, if we may believe the natives, the pestilent exhalations rising from the bare rocks of the Raudales. These fevers of the Orinoco appeared to us to resemble those which prevail every year between New Barcelona, La Guayra, and Porto Cabello, in the vicinity of the sea; and which often degenerate into adynamic fevers. " $\mathbf{I}$ have had my little fever (mi calenturita) only eight months," said the good missionary of the Atures, who accompanied us: to the Rio Negro; speaking of it as of an habitual evil, easy to be borne. The fits were violent, but of short duration. He was sometimes seized with them when lying along in the boat under a shelter of branches of trees, sometimes when exposed to the burning rays of the sun on an open beach. These tertian agues are attended with great debility of the muscular system; yet we find poor ecclesiastics on the Orinoco, who endure for several years these calenturitas, or tercianas: their effects are not so fatal as those which are experienced from ferers of mach shorter duration in temperate climates.

I have just alluded to the noxious influence on the salubrity of the atmosphere, which is attributed by the natives, and even the missionaries, to the bare rocks. This opinion is the more worthy of attention, as it is connected with
a physical phenomenon lately observed in different parts of the globe, and not yet sufficiently explained. Among the cataracts, and wherever the Orinoco, between the Missions of Carichana and of Santa Barbara, periodically washes the granitic rocks, they become smooth, black, and as if coated with plumbago. The colouring matter does not penetrate the stone, which is coarse-grained granite, containing a few solitary crystals of hornblende. Taking a general view of the primitive formation of Atures, we perceive, that, like the granite of Syene in Egypt, it is a granite with hornblende, and not a real syenite formation. Many of the layers are entirely destitute of hornblende. The blaek crust is 0.3 of a line in thickness; it is found chiefly on the quartzose parts. The crystals of feldspar sometimes preserve externaliy their reddish-white colour, and rise above the black crust. On breaking the stone with a hammer, the inside is found to be white, and without any trace of decomposition. These enormous atony masses appear sometimes in rhombs, sometimes under those hemispheric forms, peculiar to granitic rocks when they separate in blocks. They give the landscape a singularly gloomy aspect; their colour being in strong contrast with that of the foam of the river which covers them, and of the vegetation by which they are surrounded. The Indians say, that the rocks are 'burnt' (or carbonized) 'by the rays of the sun.' We saw them not only in the bed of the Orinoco, but in some spots as far as five hundred toises from its present shore, on heights which the waters now never reach even in their greatest swellings.

What is this brownish black crust, which gives these rocks, when they have a globular form, the appearance of meteoric stones? What idea can we form of the action of the water, which produces a deposit, or a change of colour, so extraordinary? We must observe, in the first place, that this phenomenon does not belong to the cataracts of the Orinoco alone, but is found in both hemispheres. At my return from Mexico in 1807, when I showed the granites of Atures and Maypures to M. Rozière, who had travelled over the valley of Eyypt, the coasts of the Red Sea, and Mount Sinai, this leamed geologist pointed out to me that the primitive rocks of the little cataracts of Syene display,
like the rocks of the Orinoco, a glossy surface, of a blackishgrey, or almost leaden colour, and of which some of the fragments seem coated with tar. Recently, in the unfortunate expedition of Captain Tuckey, the English naturalists were struck with the same appearance in the yellalas (rapids and shoals) that obstruct the river Congo or Zaire. Dr. Kœnig has placed in the British Museum, beside the syenites of the Congo, the granites of Atures, taken from a series of rocks which were presented by M. Bonpland and myself to the illustrious president of the Royal Society of London. "These fragments," says Mr. Kœnig, "alike resemble meteoric stones; in both rocks, those of the Orinoco and of Africa, the black crust is composed, according to the analysis of Mr. Children, of the oxide of iron and manganese." Some experiments made at Mexico, conjointly with Señor del Rio, led me to think that the rocks of Atures, which blacken the paper in which they are wrapped,* contain, besides oxide of manganese, carbon, and supercarburetted iron. At the Ornoco, granitic masses of forty or fifty feet thick are uniformly coated with these oxides; and, however thin these crusts may appear, they must nevertheless contain pretty considerable quantities of iron and manganese, since they occupy a space of above a league square.

It must be observed that all these phenomena of coloration have hitherto appeared in the torrid zone only, in rivers that have periodical overflowings, of which the habitual temperature is from twenty-four to twenty-eight centesimal degrees, and which flow, not over gritstone or calcareous rocks, but over granite, gneiss, and hornblende rocks. Quartz and feldspar scarcely contain five or six thousandths of oxide of iron and of manganese; but in mica and hornblende these oxides, and particularly that of iron, amount, according to Klaproth and Herrmann, to fifteen or twenty parts in a hundred. The hornblende contains also some carbon, like the Lydian stone and kieselschiefer. Now, if these black crusts were formed by a slow decomposition of

[^262]the granitic rock, under the double influence of humidity and the tropical sun, how is it to be conceived that these oxides are spread so uniformly over the whole surface of the stony masses, and are not more abundant round a crystal of mica or hornblende than on the feldspar and milky quartz? The ferruginous sandstones, granites, and marbles, that become cinereous and sometimes brown in damp air, have an aspect altogether different. In reflecting upon the lustre and equal thickness of the crusts, we are rather inclined to think that this matter is deposited by the Orinoco, and that the water has penetrated even into the clefts of the rocks. Adopting this hypothesis, it may be asked whether the river holds the oxides suspended like sand and other earthy substances, or whether they are found in a state of chemical solution. The first supposition is less admissible, on account of the homogeneity of the crusts, which contain neither grains of sand, nor spangles of mica, mixed with the oxides. We must then recur to the idea of a chemical solution; and this idea is no way at variance with the phenomena daily observable in our laboratories. The waters of great rivers contain carbonic acid; and, were they even entirely pure, they would still be capable, in very great volumes, of dissolving some portions of oxide, or those metallic hydrates which are regarded as the least soluble. The mud of the Nile, which is the sediment of the matters which the river holds suspended, is destitute of manganese ; but it contains, according to the analysis of M. Regnault, six parts in a hundred of oxide of iron; and its colour, at first black, changes to yellowish brown by desiccation and the contact of air. The mud consequently is not the cause of the black crusts on the rocks of Syene. Berzelius, who, at my request, examined these crusts, recognized in them, as in those of the granites of the Orinoco and River Congo, the union of iron and manganese. That celebrated chemist was of opinion that the rivers do not take up these oxides from the soil over which they flow, but that they derive them from their subterranean sources, and deposit them on the rocks in the manner of cementation, by the action of particular affinities, perhaps by that of the potash of the feldspar. A long residence at the cataracts of the Orinoco, the Nile, and the

Rio Congo, and an examination of the circumstamoces attendant on this phenomenon of coloration, could alone lead to the complete solution of the problem we have discussed. Is this phenomenon independent of the nature of the rocks? I shall content myself with observing, in general, that neither the granitic masses remote from the ancient bed of the Orinoco, but exposed during the rainy season to the alternations of beat and moisture, nor the granitic rocks bathed by the brownish waters of the Rio Negro, assume the appearance of meteoric stones. The Indians say, "that the rocks are black only where the waters are white." They ought, perhaps, to add, "where the waters acquire great swiftness, and strike with force against the rocks of the banks." Cementation seems to explain why the crusts augmest so little in thickness.

I know not whether it be an error, but in the Missions of the Orinoco, the neighbourhood of bare rocks, and especially of the masses that have crusts of carbon, oxide of iron, and manganese, are considered injurious to health. In the torrid zone, still more than in others, the people multiply pathogenic causes at will. They are afraid to sleep in the open air, if forced to expose the face to the rays of the full moon. They also think it dangerous to sleep on granite near the river; and many examples are cited of persons, who, after having passed the night on these black amd naked rocks, have awakened in the morning with a strong paroxysm of fever. Without entirely lending faith to the assertions of the missionaries and natives, we generally avoided the laxas nogras, and stretched ourselves on the beach covered with white sand, when we found no tree from which to suspend our hammocks. At Carichana, the village is intended to be destroyed, and its place changed, merely to remove it from the 'black rocks,' or from a site where, for a space of more than ten thoussand square toises, banks of bare granite form the surface. From similar motives, which must appear very chimerical to the naturalists of Europe, the Jesuits Olmo, Forneri, and Mellis, removed a village of Jaruros to three different spots, between the Raudal of Tabaje and the Rio Anaveni. I merely state these faets as they were related to me, because we are almost wholly ignorant of the nature of the gaseous mixtures
which cause the insalubrity of the atmosphere. Can it be admitted that, under the influence of excessive heat and of constant humidity, the black crusts of the granitic rocks are capable of acting upon the ambient air, and producing miasmata with a triple basis of carbon, azote, and hydrogen? This I doubt. The granites of the Orinoco, it is true, often contain hornblende; and those who are accustomed to practical labour in mines are not ignorant that the most noxious exhalations rise from galleries wrought in syenitic and hornblende rocks: but in an atmosphere renewed every instant by the action of little currents of air, the effect cannot be the same as in a mine.

It is probably dangerous to sleep on the laxas negras, only because these rocks retain a very elevated temperature during the night. I have found their temperature in the day at $48^{\circ}$, the air in the shade being at $29 \cdot 7^{\circ}$; during the night the thermometer on the rock indicated $36^{\circ}$, the air being at $26^{\circ}$. When the accumulation of heat in the stony masses has reached a stationary degree, these masses become at the same hours nearly of the same temperature. What they. have acquired more in the day they lose at night by radiation, the force of which depends on the state of the surface of the radiating body, the interior arrangement of its particles, and, above all; on the clearness of the sky, that is, on the transparency of the atmosphere and the absence of clouds. When the declination of the sun varies very little, this luminary adds daily nearly the same quantities of heat, and the rocks are not hotter at the end than in the middle of summer. There is a certain maximum which they cannot pass, because they do not change the state of their surface, their density, or their capacity for caloric. On the shores of the Orinoco, on getting out of one's hammock during the night, and touching with the bare feet the rocky surface of the ground, the sensation of heat experienced is very remarkable. I observed pretty constantly, in putting the bulb of the thermometer in contact with the ledges of bare rocks, that the laxas negras are hotter during the day than the reddish-white granites at a distance from the river; but the latter cool during the night less rapidly than the former. It may be easily conceived that the emission and loss of caloric is more rapid in masses with
black crusts than in those which abound in laminæ of silvery mica. When walking between the hours of one and three m the afternoon, at Carichana, Atures, or Maypures, among those blocks of stone destitute of vegetable mould, and piled up to great heights, one feels a sensation of suffocation, as if standing before the opening of a furnace. The winds, if ever felt in those woody regions, far from bringing coolness, appear more heated when they have passed over beds of stone, and heaps of rounded blocks of granite. This augmentation of heat adds to the insalubrity of the climate.

Among the causes of the depopulation of the Raudales, I have not reckoned the small-pox, that malady which in other parts of America makes such cruel ravages that the natives, seized with dismay, burn their huts, kill their children, and renounce every kind of society. This scourge is almost unknown on the banks of the Orinoco, and should it penetrate thither, it is to be hoped that its effects may be immediately counteracted by vaccination, the blessings of which are daily fett along the coasts of Terra Firma. The causes which depopulate the Christian settlements are, the repugnance of the Indians for the regulations of the missions, insalubrity of climate, bad nourishment, want of care in the diseases of children, and the guilty practice of preventing pregnancy by the use of deleterious herbs. Among the barbarous people of Guiana, as well as those of the half-civilized islands of the South Sea, young wives are fearful of becoming mothers. If they have children, their offspring are exposed not only to the dangers of savage life, but also to other dangers arising from the strangest popular prejudices. When twins are born, false notions of propriety and family honour require that one of them should be destroyed. "To bring twins into the world," say the Indians, " is to be exposed to public scorn; it is to resemble rats, opossums, and the vilest animals; which bring forth a great number of young at a time." Nay, more, they affirm that "two children born at the same time cannot belong to the same father." This is an axiom of physiology among the Salives; and in every zone, and in different states of society, when the vulgar seize upon an axiom, they adhere to it with more stedfastness than the better-informed men by whom it was first hazarded. To
avoid the disturbance of conjugal tranquillity, the old female relations of the mother take care, that when twins are born one of them shall disappear. If a new-born infant, though not a twin, have any physical deformity, the father instantly puts it to death. They will have none but robust and wellmade children, for deformities indicate some influence of the evil spirit Ioloquiamo, or the bird Tikitiki, the enemy of the human race. Sometimes children of a feeble constitution undergo the same fate. When the father is asked what is become of one of his sons, he will pretend that he has lost him by a natural death. He will disavow an action. that appears to him blameable, but not criminal. "The poor boy," he will tell you, "could not follow us; we must have waited for him every moment; he has not been seen again ; he did not come to sleep where we passed the night." Such is the candour and simplicity of manners-such the boasted happiness-of man in the state of nature! He kills his son to escape the ridicule of having twins, or to avoid journeying more slowly; in fact, to avoid a little inconvenience.

These acts of cruelty, I confess, are less frequent than they are believed to be; yet they occur even in the Missions, during the time when the Indians leave the village, to retire to the conucos of the neighbouring forests. It would be erroneous to attribute these actions to the state of polygamy in which the uncatechized Indians live. Polygamy no doubt diminishes the domestic happiness and internal union of families; but this practice, sanctioned by Ismaelism, does not prevent the pcople of the east from loving their children with tenderness. Among the Indians of the Orinoco, the father returns home only to eat, or to sleep in his hammock; he lavishes no caresses on his infants, or on his wives, whose office it is to serve him. Parental affection begins to display itself only when the son has become strong enough to take a part in hunting, fishing, and the agricultural labours of the plantations.

While our boat was unloading, we examined closely, wherever the shore could be approached, the terrific spectacle of a great river narrowed and reduced as it were to foam. I shall endeavour to paint, not the sensations we felt, but the aspect of a spot so celebrated among the scenes of
the New World. The more imposing and majeotic the objects we describe, the more essential it becomes to seive them in their smallest details, to fix the outline of the picture we would present to the imagination of the reader, and to describe with simplicity what characterises the great and imperishable monuments of nature.

The navigation of the Orinoeo from its mouth as far as the confluence of the Anaveni, an extent of 260 leagues, is not impeded. There are shoals and eddies near Muitaco, in a cove that bears the name of the Mouth of Hell (Boca del Infierno) ; and there are rapids (raudalitos) near Carichana and San Borja; but in all these places the river is never entirely barred, as a channel is left by which boats can pass up and down.

In all this navigation of the Lower Orinoco travellers experience no other danger than that of the natural rafts formed by trees, which are uprooted by the river, and swept along in its great floods. Woe to the canoes that during the night strike against these rafts of wood interwoven with lianas! Covered with aquatic plants, they resemble here, as in the Mississippi, floating meadows, the chinampas or floating gardens of the Mexiean lakes. The Indians, when they wish to surprise a tribe of their enemies, bring together several canoes, fasten them to each other with cords, and cover them with grass and branches, to imitate this assemblage of trunks of trees, which the Orinoco sweeps along in its middle current. The Caribs are accused of having heretofore excelled in the use of this artifice; at present the Spanish smugglers in the neighbourhood of Angostura have recourse to the same expedient to escape the vigilance of the custom-house officers.

After proceeding up the Orinoco beyond the Rio Anaveni, we find, between the mountains of Uniana and Sipapu, the Great Cataracts of Mapara and Quittuna, or, as they are more commonly called by the missionaries, the Raudales of Atures and Maypures. These bars, which extend from one bank to the other, present in general a similar aspect: they are composed of imnumerable islands, dikes of rock, and blocks of granite piled on one another and covered with palm-trees. But, notwithstanding a uniformity of aspect, each of these cataracts preserves an individual character.

The first, the Atures, is most easily passable when the waters are low. The Indians prefer crossing the sceond, the Maypures, at the time of great floods. Beyond the Maypures and the mouth of the Caño Cameji, the Orinoeo is again unobstructed for the length of more than one hundred and sixty-seven leagues, or nearly to its sounce; that is to say, as far as the Raudalito of Guaharibos, east of the Caño Chiguire and the lofty mountains of Yumariquin.

Having visited the basins of the two rivers Orinoco and Amazon, I was singularly struck by the differences they display in their course of unequal extent. The falls of the Amazon, which is nearly nine hundred and eighty nautical leagues (twenty to a degree) in length, are pretty near its source in the first sixth of its total length, and five-sixths of its course are entirely free. We find the great falls of the Orinoco on a point far more unfavourable to navigation; if not at the half, at least much beyond the first third of its length. In both rivers it is neither the moantains, nor the different stages of flat lands lying over one another, whence they take their origin, that cause the cataracts; they are produced by other mountains, other ledges which, after a long and tranquil course, the rivers have to pass over, precipitating themselves from step to step.

The Amazon does not pierce its way through the principal chain of the Andes, as was affirmed at a period when it was gratuitously supposed that, wherever mountains are divided into parallel chains, the intermedial or central ridge must be more elevated than the others. This great river rises (and this is a point of some importance to geology) eastward of the western chain, which alone in this latitude merits the denomination of the high chain of the Andes. It is formed by the junction of the river Aguamiros with the Rio Chavinillo, which issues from the lake Llauricocha in a longitudinal valley bounded by the western and the intermedial chain of the Andes. To form an accurate idea of these hydrographical relations, it must be borne in mind that a division into three ehains takes place in the colossal group or knot of the mountains of Pasco and Huanueo. The western chain, which is the loftiest, and takes the name of the Cordillena Real de Nieve, directs its course (between Huary and Caxatamba, Guamachuco and Luema, Micui-
pampa and Guangamarca) by the Nevados of Viuda, Pelagatos, Moyopata, and Huaylillas, and by the Paramos of Guamani and Guaringa, towards the town of Loxa. The intermedial chain separates the waters of the Upper Marañon from those of the Guallaga, and over a long space reaches only the small elevation of a thousand toises; it enters the region of perpetual snow to the south of Huanuco in the Cordillera of Sasaguanca. It stretches at first northward by Huacrachuco, Chachapoyas, Moyobamba, and the Paramo of Piscoguannuna; then it progressively lowers toward Peca, Copallin, and the Mission of Santiago, at the eastern extremity of the province of Jaen de Bracamoros. The third, or easternmost chain, skirts the right bank of the Rio Guallaga, and loses itself in the seventh degree of latitude. So long as the Amazon flows from south to north in the longitudinal valley, between two chains of unequal height (that is, from the farms of Quivilla and Guancaybamba, where the river is crossed on wooden bridges, as far as the confluence of the Rio Chinchipe), there are neither bars, nor any obstacle whatever to the navigation of boats. The falls of water begin only where the Amazon turns toward the east, crossing the intermedial chain of the Andes, which widens considerably toward the north. It meets with the first rocks of red sandstone, or ancient conglomerate, between Tambillo and the Pongo of Rentema (near which I measured the breadth, depth, and swiftness of the waters), and it leaves the rocks of red sandstone east of the famous strait of Manseriche, near the Pongo of Tayuchuc, where the hills rise no higher than forty or fifty toises above the level of its waters. The river does not reach the most easterly chain, which bounds the Pampas del Sacramento. From the hills of Tayuchuc as far as Grand Para, during a course of more than seven hundred and fifty leagues, the navigation is free from obstacles. It results from this rapid sketch, that, if the Marañon had not to pass over the hilly country between Santiago and Tomependa (which belongs to the central chain of the Andes) it would be navigable from its mouth as far as Pumpo, near Piscobamba in the province of Conchucos, forty-three leagues north of its source.

We have just seen that, in the Orinoco, as in the Amazon,
the great cataracts are not found near the sources of the rivers. After a tranquil course of more than one hundred and sixty leagues from the little Raudal of Guaharibos, east of Esmeralda, as far as the mountains of Sipapu, the river, augmented by the waters of the Jao, the Ventuari, the Atabapo, and the Guaviare, suddenly changes its primitive direction from east to west, and runs from south to north: then, in crossing the land-strait* in the plains of Meta, meets the advanced buttresses of the Cordillera of Parima. This obstacle causes cataracts far more considerable, and presents greater impediments to navigation, than all the Pongos of the Upper Marañon, because they are proportionally nearer to the mouth of the river. These geographical details serve to prove, in the instances of the two greatest rivers of the New World, 1st, that it cannot be ascertained in an absolute manner that, beyond a certain number of toises, or a certain height above the level of the sea, rivers are not navigable; 2ndly, that the rapids are not always occasioned, as several treatises of general topography affirm, by the height of the first. obstacles, by the first lines of ridges which the waters have to surmount near their sources.

The most northern of the great cataracts of the Orinoco is the only one bounded on each side by lofty mountains. The left bank of the river is generally lower, but it makes part of a plane which rises again west of Atures, towards the Peak of Uniana, a pyramid nearly three thousand feet high, and placed on a wall of rock with steep slopes. The situation of this solitary peak in the plain contributes to render its aspect more imposing and majestic. Near the Mission, in the country which surrounds the cataract, the aspect of the landscape varies at every step. Within a small space we find all that is most rude and gloomy in nature, united with an open country and lovely pastoral scenery. In the physical, as in the moral world, the contrast of effects, the comparison of what is powerful and menacing with what is soft and peaceful, is a never-failing source of our pleasures and our emotions.

I shall here repeat some scattered features of a picture,
*This strait, which I have several times mentioned, is formed by the Cordilleras of the Andes of New Granada, and the Cordillera of Parima.
which I traeed in another work shortly after my return to Europe.* The savannahs of Atures, covered with slender plants and grasses, are really meadows resembling those of thurope. They are never inundated by the rivers, and seem as if waiting to be ploughed by the hand of man. Notwithstanding their extent, these savannahs do not exhibit the monotony of our plains; they surround groups of rocks and blocks of granite piled on one another. On the very bordess of these plains and this open country, glens are seen seaccely lighted by the rays of the setting sun, and hollows where the hamid soil, loaded with arums, heliconias, and limas, manifests at every step the wild fecundity of nature. Ererywhere, just rising above the earth, appear those shelves of granite completely bare, which we saw at Carichana, and which I have already described. Where springs gush from the bowom of these rocks, verrucarias, psoras, and liehens are fixed on the decomposed granite, and have there aecumalated monld. Little euphorbias, peperomias, and other succulent plants, have taken the place of the cryptogamous tribes; and evergreen shrubs, rhexias, and purpleflowered melastomas, form verdant isles amid desert and rocky plains. The distribution of these spots, the clusters of small trees with coriaceous and shining leaves scattered in the savannahs, the limpid rills that dig channels across the rocks, and wind alternately through fertile places and over bare shelves of granite, all call to mind the most lovely and picturesque plantations and pleasure-grounds of Europe. We seem to recognise the industry of man, and the traces of cultivation, amid this wild scenery.

The lofty mountains that bound the horizon on every side, contribute also, by their forms and the nature of their vegetation, to give an extraordinary character to the landscape. The average height of these mountains is not more than seven or eight hundred feet above the surrounding plains. Their summits are rounded, as for the most part in granitic mountains, and covered with thick forests of the laurel-tribe. Clusters of palm-trees, $\dagger$ the leaves of which, curled like feathers, rise majestically at an angle of seventy degrees, are dispersed amid trees with horizontal branches;

* Views of Nature, p. 153 (Bohn's edition).
+ El cucurito.
and their bare trunks, like columns of a handred or a hundred and twenty feet high, shoot up into the air, and when seen in distinct relief against the azure vault of the sky, they resemble a forest planted upon another forest. When, as the moon was going down behind the mountains of Uniana, her reddish disc was hidden behind the pinnated foliage of the palm-trees, and again appeared in the aerrial zone that separates the two forests, I thought myself transported for a few moments to the hermitage which Bernardin de Saint-Pierre has described as one of the most delicions scenes of the Isle of Bourbon, and I felt how much the aspect of the plants and their groupings resembled each other in the two worlds. In describing a small spot of land in an island of the Indian Ocean, the inimitable author of Paul and Virginia has sketched the vast picture of the landscape of the tropics. He knew how to paint nature, not because he had studied it scientifically, but because he felt it in all its harmonious analogies of forms, colours, and interior poweas.

East of the Aturen, near these rounded mountains crowned, as it were, by two superimposed forests of laurels and palms, other mountains of a very different aspect arise. Their ridge is bristled with pointed rocks, towering like pillars above the summits of the trees and shrubs. These effects are common to all granitic table-lands, at the Harz, in the metalliferous mountains of Bohemia, in Galicia, on the limit of the two Castiles, or wherever a granite of new formation appears above the ground. The rocks, which are at distances from each other, are composed of blocks piled together, or divided into regular and horizontal beds. On the summits of those situated near the Orinoco, flamingos, soldados," and other fishing-birds perch, and look like men posted as sentinels. This resemblance is so striking, that the inhabitants of Angostura, soon after the foundation of their city, were one day alarmed by the sudden appearance of soldados and garzas, on a mountain towards the south. They believed they were menaced with an attack of Indios monteros (wild Indians called mountaineers); and the people mere not perfectly tranquillized, till they saw the birds soar-

* The soldado (soldier) is a large species of heron.
ing in the air, and continuing their migration towards the mouths of the Orinoco.

The fine vegetation of the mountains spreads over the plains, wherever the rock is covered with mould. We generally find that this black mould, mixed with fibrous vegetable matter, is separated from the granitic rock by a layer of white sand. The missionary assured us that verdure of perpetual freshness prevails in the vicinity of the cataracts, produced by the quantity of vapour which the river, broken into torrents and cascades for the length of three or four thousand toises, diffuses in the air.

We had not heard thunder more than once or twice at Atures, and the vegetation everywhere displayed that vigorous aspect, that brilliancy of colour, seen on the coast only at the end of the rainy season. The old trees were decorated with beautiful orchideas,* yellow bannisterias, blue-flowered bignonias, peperomias, arums, and pothoses. A single trunk displays a greater variety of vegetable forms than are contained within an extensive space of ground in our countries. Close to the parasite plants peculiar to very hot climates we observed, not without surprise, in the centre of the torrid zone, and near the level of the sea, mosses resembling in every respect those of Europe. We gathered, near the Great Cataract of Atures, that fine specimen of .Grimmiat with fontinalis leaves, which has so much fixed the attention of botanists. It is suspended to the branches of the loftiest trees. Of the phænerogamous plants, those which prevail in the woody spots are the mimosa, ficus, and laurinea. This fact is the more characteristic as, according to the observations of Mr. Brown, the laurinem appear to be almost entirely wanting on the opposite continent, in the equinoctial part of Africa. Plants that love humidity adorn the scenery surrounding the cataracts. We there find in the plains groups of heliconias and other scitaminem with large and glossy leaves, bamboos, and the three palm-trees, the murichi,

* Cymbidium violaceum, Habenaria angustifolia, \&c.
$\dagger$ Grimmia fontinaloĩdes. See Hooker's Musci Exotici, 1818, tab. ii. The learned author of the Monography of the Jungermannize (Mr. Jackson Hooker), with noble disinterestedness, published at his own expense, in London, the whole collection of cryptogamous plants, brought by Bonpland and Humboldt from the equinoctial regions of America
jagua, and vadgiai, each of which forms a separate group. The murichi, or mauritia with scaly fruits, is the celebrated sago-tree of the Guaraon Indians. It has palmate leaves, and has no relation to the palm-trees with pinnate and curled leaves; to the jagua, which appears to be a species of the cocoa-tree; or to the vadgiar or cucurito, which may be assimilated to the fine species Oreodoxa. The cucurito, which is the palm most prevalent around the cataracts of the Atures and Maypures, is remarkable for its stateliness. Its leaves, or rather its palms, crown a trunk of eighty or one hundred feet high; their direction is almost perpendicular when young, as well as at their full growth, the points only being incurvated. They look like plumes of the most soft and verdant green. The cucurito, the pirijao, the fruit of which resembles the apricot, the Oreodoxa regia or palma real of the island of Cuba, and the ceroxylon of the high Andes, are the most majestic of all the palm-trees we saw in the New World. As we advance toward the temperate zone, the plants of this family decrease in size and beauty. What a difference between the species we have just mentioned, and the date-tree of the East, which unfortunately has become to the landscape painters of Europe the type of a group of palm-trees!

It is not suprising that persons who have travelled only in the north of Africa, in Sicily, or in Spain, cannot conceive that, of all large trees, the palm is the most grand and beautiful in form. Incomplete analogies prevent Europeans from having a just idea of the aspect of the torrid zone. All the world knows, for instance, that this zone is embellished by the contrasts exhibited in the foliage of the trees, and particularly by the great number of those with pinnate leaves. The ash, the service-tree, the inga, the acacia of the United States, the gleditsia, the tamarind, the mimosa, the desmanthus, have all pinnate leaves, with foliolm more or less long, slender, tough, and shining. But can a group of ash-trees, of service-trees, or of sumach, recall the picturesque effect of tamarinds or mimosas, when the azure of the sky appears through their small, slender, and delicately pinnated leaves? These considerations are more important than they may at first seem. The forms of plants determine the physiognomy of nature; and this physiognomy influences the

[^263]moral dispositions of nations. Every type comprehends specien, which, while exhibiting the same general appearance, differ in the varied development of the similar organs. The palm-trees, the scitaminex, the malvacea, the trees with pinnate leaves, do not all display the same picturesque beauties ; and generally the most beantiful species of each type, in plants as in animals, belong to the equinoctial zone.
The proteaces,* crotons, agaves, and the great tribe of the cactuses, which inhabit exclusively the New World, disappear gradually, as we ascend the Orinoco above the Apure and the Meta. It is, however, the shade and humidity, rather than the distance from the coast, whieh oppose the migration of the cactuses southward. We found forests of them mingled with crotons, covering a great space of arid land to the east of the Andes, in the province of Bracamoros, towards the Upper Marañon. The arborescent ferns seem to fail entirely near the cataraets of the Orinoco; we found no species as far as San Fernando de Atabapo, that is, to the confluence of the Orinoco and the Guaviare.

Having now examined the vicinity of the Atures, it remains for me to speak of the rapids themselves, which occur in a part of the valley where the bed of the river, deeply ingulfed, has almost inaccessible banks. It was only in a very few spots that we could enter the Orinoco to bathe, between the two cataracts, in coves where the waters have eddies of little velocity. Persons who have dwelt in the Alps, the Pyrenees, or even the Cordilleras, so celebrated for the fractures and the vestiges of destruction which they display at every step, can scarcely picture to themselves, from a mere narration, the state of the bed of the river. It is traversed, in an extent of more than five miles, by innumerable dikes of rock, forming so many natural damas, so many barriers resembling those of the Dnieper, which the ancients designated by the name of phragmoi. The space between the rocky dikes of the Orinoco is filled with islands of different dimensions; some hilly, divided into several peaks, and two or three hundred toises in length, others small, low, and like mere shoals. These islands divide the river into a number of torrents, which boil up as

[^264]they break against the rocks. The jaguas and cucuritos with plumy leaves, with which all the islands are covered, seem like groves of palm-trees rising from the foamy surface of the waters. The Indians, whose task it is to pass the boats empty over the raudales, distinguish every shelf, and every rock, by a particular name. On entering from the south you find first the Leap of the Toucan (Salto del Piapoco); and between the islands of Avaguri and Javariveni is the Raudal of Javariveni, where, on our return from Rio Negro, we passed some hours amid the rapids, waiting for our boat. A great part of the river appeared dry. Blocks of granite are heaped together, as in the moraines which the glaciers of Switzerland drive before them. The river is ingulfed in caverns; and in one of these caverns we heard the water roll at once over our heads and beneath our feet. The Orinoco seems divided into a multitude of arms or torrents, each of which seeks to force a passage through the rocks. We were struck with the little water to be seen in the bed of the river, the frequency of subterraneous falls, and the tumult of the waters breaking on the rocks in foam.

> Cuncta fremunt undis; ac multo murmure montis Spumeus invictis canescit fluctibus amnis.*

Having passed the Raudal of Javariveni (I name here only the principal falls) we come to the Raudal of Canucari, formed by a ledge of rocks uniting the islands of Surupamana and Uirapuri. When the dikes, or natural dams, are only two or three feet high, the Indians venture to descend them in boats. In going up the river, they swim on before, and if, after many vain efforts, they succeed in fixing a rope to one of the points of rock that crown the dike, they then, by means of that rope, draw the bark to the top of the raudal. The bark, during this arduous task, often fills with water; at other times it is stove against the rocks, and the Indians, their bodies bruised and bleeding, extricate themselves with difficulty from the whirlpools, and reach, by swimming, the nearest island. When the steps or rocky barriers are very high, and entirely bar the river, light boats are carried on shore, and with the help of branches of trees

[^265]placed under them to serve as rollers, they are drawn as far as the place where the river again becomes navigable. This operation is seldom necessary when the water is high. We cannot speak of the cataracts of the Orinoco without recalling to mind the manner heretofore employed for descending the cataracts of the Nile, of which Seneca has left us a description probably more poetical than accurate. I shall cite the passage, which traces with fidelity what may be seen every day at Atures, Maypures, and in some pongos of the Amazon. "Two men embark in a small boat; one steers, and the other empties it as it fills with water. Long buffeted by the rapids, the whirlpools, and the contrary currents, they pass through the narrowest channels, avoid the shoals, and rush down the whole river, guiding the course of the boat in its accelerated fall."*

In hydrographic descriptions of countries, the vague names of cataracts, cascades, falls, and rapids, $\dagger$ denoting those tumultuous movements of water which arise from very different circumstances, are generally confounded with one another. Sometimes a whole river precipitating itself from a great height, and by one single fall, renders navigation impossible. Such is the majestic fall of the Rio Tequendama, which I have represented in my "Views of the Cordilleras;' such are the falls of Niagara and of the Rhine, much less remarkable for their elevation, than for the mass of water they contain. Sometimes stony dikes of small height succeed each other at great distances, and form distinct falls; such are the cachoeiras of the Rio Negro and the Rio Madeira, the saltos of the Rio Cauca, and the greater part of the pongos that are found in the Upper Marañon, from the confluence of the Chinchipe to the village of San Borja. The highest and most formidable of these pongos, which are descended on rafts, that of Mayasi, is however only three feet in height. Sometimes small rocky dikes are so near each other that they form for several miles an uninterrupted succession of cascades and whirlpools (chorros and remolinos); these are properly

[^266]what are called rapids (raudales). Such are the yellalas, or rapids of the River Zaire,* or Congo, which Captain Tuckey has recently made known to us; the rapids of the Orange River in Africa, above Pella; and the falls of the Missouri, which are four leagaes in length, where the river issues from the Rocky Mountains. Such also are the cataracts of Atures and Maypures; the only cataracts which, situated in the equinoctial region of the New World, are adorned with the noble growth of palm-trees. At all seasons they exhibit the aspect of cascades, and present the greatest obstacles to the navigation of the Orinoco, while the rapids of the Ohio and of Upper Egypt are scarcely visible at the period of floods. A solitary cataract, like Niagara, or the cascade of Terni, affords a grand but single picture, varying only as the observer changes his place. Rapids, on the contrary, especially when adorned with large trees, embellish a landscape during a length of several leagues. Sometimes the tumultuous movement of the waters is caused only by extraordinary contractions of the beds of the rivers. Such is the angostura of Carare, in the river Magdalena, a strait that impedes communication between Santa Fé de Bogotá and the coast of Carthagena; and such is the pongo of Manseriche, in the Upper Marañon.

The Orinoco, the Rio Negro, and almost all the confluents of the Amazon and the Marañon, have falls or rapids, either because they cross the mountains where they take rise, or because they meet other mountains in their course. If the Amazon, from the pongo of Manseriche (or, to speak with more precision, from the pongo of Tayuchuc) as far as its mouth, a space of more than seven hundred and fifty leagues, exhibit no tumultuous movement of the waters, the river owes this advantage to the uniform direction of its course. It flows from west to east in a vast plain, forming

* Voyage to explore the River Zaire, 1818, pp. 152, 327, 340. What the inhabitants of Upper Egypt and Nubia call chellál in the Nile, is called yellala in the River Congo. This analogy between words signifying rapids is remarkable, on account of the enormous distance of the yellalas of the Congo from the chellall and djenadel of the Nile. Did the word chellal penetrate with the Moors into the west of Africa? If, with Burckhardt, we consider the origin of this word as Arabic (Travels in Nubia, 1819), it must be derived from the root challa, 'to disperse,' which forms chelil, ' water falling through a narrow channel.'
a longitudinal valley between the mountains of Parima and the great mass of the mountains of Brazil.

I was surprised to find by actual measurement that the rapids of the Orinoco, the roar of which is heard at the distance of more than a league, and which are so ominently picturesque from the varied appearance of the waters, the palm-trees and the rocks, have not probably, on their whole length, a height of more than twenty-eight feet perpendicular. In reflecting on this, we find that it is a great deal for rapids, while it would be very little for a single cataract. The Yellalas of the Rio Congo, in the contracted part of the river from Banza Noki as far as Banza Inga, furmish, between the upper and lower levels, a much more considerable difference; but Mr. Barrow observes, that among the great number of these rapids there is one fall, which alone is thirty feet high. On the other hand, the famous pongos of the river Amazon, so dangerous to go up, the falls of Rentema, of Escurrebragas, and of Mayasi, are but a few feet in perpendicular height. Those who are engaged in hydraulic works know the effect that a bar of eighteen or twenty inches' height produces in a great river. The whirling and tumultuous movement of the water does not depend solely on the greatness of partial falls; what determines the force and impetuosity is the nearness of these falls, the steepness of the rocky ledges, the returning sheets of water which strike against and surmount each other, the form of the islands and shoals, the direction of the counter-carrents, and the contraction and sinuosity of the channels through which the waters force a passage between two adjacent levels. In two rivers equally large, that of which the falls have least height may sometimes present the greatest dangers and the most impetuous movements.

It is probable that the river Orinoco loses part of its waters in the cataracts, not only by increased evaporation, caused by the dispersion of minute drops in the atmosphere, but still more by filtrations into the subterraneous cavities. These losses, however, are not very perceptible when we compare the mass of waters entering into the raudal with that which issues out near the mouth of the Rio Anaveni. It was by a similar comparison that the
erimence of sabterraneous cavities in the gellalas or rapids of the river Congo was discovered. The pongo of Manse riche, which ought rather to be called a strait than a fall, ingalfs, in a manner not yet safficiently explored, a part of the waters and all the floating wood of the Upper Marañon.

The spectator, seated on the bank of the Orinoco, with his eyes fixed on those rocky dikes, is naturally led to inquire whether, in the lapse of ages, the falls change their form or height. I am not much inelined to believe in such effects of the shock of water against blocks of granite, and in the erosion of siliceons matter. The holes narrowed toward the bottom, the funnels that are discovered in the raudales, as well as near so many other cascades in Europe, are owing only to the friction of the sand, and the movement of quartz pebbles. We saw many such, whirted perpetually by the carrent at the bottom of the funmels, and contributing to enlarge them in every direction. The pongos of the river Amazon are easily destroyed, because the rocky dikes are not gramite, but a conglomerate, or red sandstone with large fragments. A part of the pongo of Rentema was broken down eighty years ago, and the courso of the waters being interrupted by a new bar, the bed of the river remained dry for some hours, to the great astonishment of the inhabitarts of the village of Payaya, seven leagaes below the pongo. The Indians of Atures assert (and in this their testimony is contrary to the opinion of Caulin) that the rocks of the raudal preserve the same aspeet; but that the partial torrents into which the great river divides itself as it passes through the heaped blocks of granite, change their direction, and carry sometimes more, sometimes less water towards one or the other bank; but the causes of these changes may be very remote from the cataracts, for in the rivers that spread life over the surface of the globe, as in the arteries by which it is diffused through organized bodies, all the movements are propagated to great distances. Oscillations, that at first seem partial, react on the whole liquid mass contained in the trunk as well as in its numerous ramifications.

Some of the Missionaries in their writings have alleged that the inhabitants of Atures and Maypures have been track with deafness by the noise of the Great Cataracts;
but this is untrue. When the noise is heard in the plain that surrounds the mission, at the distance of more than a league, you seem to be near a coast skirted by reefs and breakers. The noise is three times as loud by night as by day, and gives an inexpressible charm to these solitary scenes. What can be the cause of this increased intensity of sound, in a desert where nothing seems to interrupt the silence of nature? The velocity of the propagation of sound, far from augmenting, decreases with the lowering of the temperature. The intensity diminishes in air agitated by a wind which is contrary to the direction of the sound; it diminishes also by dilatation of the air, and is weaker in the higher than in the lower regions of the atmosphere, where the number of particles of air in motion is greater in the same radius. The intensity is the same in dry air, and in air mingled with vapours; but it is feebler in carbonic acid gas than in mixtures of azote and oxygen. From these facts, which are all we know with any certainty, it is difficult to explain a phenomenon observed near every cascade in Europe, and which, long before our arrival in the village of Atures, had struck the missionary and the Indians.

It may be thought that, even in places not inhabited by man, the hum of insects, the song of birds, the rustling of leaves agitated by the feeblest winds, occasion during the day a confused noise, which we perceive the less because it is uniform, and constantly strikes the ear. Now this noise, however slightly perceptible it may be, may diminish the intensity of a louder noise ; and this diminution may cease if during the calm of the night the song of birds, the hum of insects, and the action of the wind upon the leaves be interrupted. But this reasoning, even admitting its justness, can scarcely be applied to the forests of the Orinoco, where the air is constantly filled by an innumerable quantity of mosquitos, where the hum of insects is much louder by night than by day, and where the breeze, if ever it be felt, blows only after sunset.

I rather think that the presence of the sun acts upon the propagation and intensity of sound by the obstacles met in currents of air of different density, and by the partial undulations of the atmosphere arising from the unequal heating
of different parts of the soil. In calm air, whether dry or mingled with vesicular vapours equally distributed, soundwaves are propagated without difficulty. But when the air is crossed in every direction by small currents of hotter air, the sonorous undulation is divided into two undulations where the density of the medium changes abruptly; partial echoes are formed that weaken the sound, because one of the streams comes back upon itself; and those divisions of undulations take place of which M. Poisson has developed the theory with great sagacity.* It is not therefore the movement of the particles of air from below to above in the ascending current, or the small oblique currents that we consider as opposing by a shock the propagation of the sonorous undulations. A shock given to the surface of a liquid will form circles around the centre of percussion, even when the liquid is agitated. Several kinds of undulations may cross each other in water, as in air, without being disturbed in their propagation: little movements may, as it were, ride over each other, and the real cause of the less intensity of sound during the day appears to be the interruption of homogeneity in the elastic medium. During the day there is a sudden interruption of density wherever small streamlets of air of a high temperature rise over parts of the soil unequally heated. The sonorous undulations are divided, as the rays of light are refracted and form the mirage wherever strata of air of unequal density are contiguous. The propagation of sound is altered when a stratum of hydrogen gas is made to rise in a tube closed at one end above a stratum of atmospheric air; and M. Biot has well explained, by the interposition of bubbles of carbonic acid gas, why a glass filled with champagne is not sonorous so long as that gas is evolved, and passing through the strata of the liquid.

In support of these ideas, I might almost rest on the authority of an ancient philosopher, whom the moderns do not esteem in proportion to his merits, though the most distinguished zoologists have long rendered ample justice to the sagacity of his observations. "Why," says Aristotle in his curious book of Problems, "why is sound better heard

* Annales de Chimie, tom. vii, p. 293.
during the night? Because there is more calmmess on account of the absence of caloric (of the hottest)." This absence renders every thing calmer, for the sun is the principle of all movement." Aristotle had no doubt a vague presentiment of the cause of the phenomenon; but he attributes to the motion of the atmosphere, and the shock of the particles of air, that which seems to be rather owing to abrupt changes of density in the contiguous strata of air.

On the 16th of April, towards evening, we received tidings that in less than six hours our boat had passed the rapids, and had arrived in good condition in a cove called el Puerto de arriba, or the Port of the Expedition. We were shown in the little church of Atures some remains of the ancient wealth of the Jesuits. A silver lamp of considerable weight lay on the ground half-buried in the sand. Sach an object, it is true, would nowhere tempt the cupidity of a savage; yet I may here remark, to the honor of the natives of the Orinoco, that they are not addicted to stealing, like the less savage tribes of the islands in the Pacific. The former have a great respect for property ; they do not even attempt to steal provision, hooks, or hatchets. At Maypures and Atures, locks on doors are unknown : they will be introduced only when whites and men of mixed race eatablish themselves in the missions.

The Indians of Atures are mild and moderate, and accustomed, from the effects of their idleness, to the greatest privations. Formerly, being excited to labour by the Jesuits, they did not want for food. The fathers cultivated maize, French beans (frijoles), and other European vegetables; they even planted sweet oranges and tamarinds round the villages; and they possessed twenty or thirty thousand head of cows and horses, in the savannahs of Atures and

[^267]Carichana. They had at their service a great number of ${ }^{\prime}$ slaves and servants (peones), to tend their herds. Nothing is now cultivated but a little cassara, and a few plantains. Such however is the fertility of the soil, that at Atures I counted on a single branch of a musa one hundred and eight fruits, four or five of which would almost have sufficed for a man's daily food. The culture of maize is entirely neglected, and the horses and cows have entirely disappeared. Near the raudal, a part of the village still bears the name of Passo del ganado (ford of the cattle), while the descendants of those very Indians whom the Jesuits had assembled in a mission, speak of horned cattle as of animals of a race now lost. In going up the Orinoco, toward San Carlos del Rio Negro, we saw the last cow at Carichana. The Fathers of the Observance, who now govern these vast countries, did not immediately succeed the Jesuits. During an interregnum of eighteen years, the missions were visited only from time to time, and by Capuchin monks. The agents of the secular government, under the title of Royal Commissioners, managed the hatos or farms of the Jesuits with culpable negligence. They killed the cattle for the sake of selling the hides. Many heifers were devoured by the jaguars, and a great number perished in consequence of wounds made by the bats of the raudales, which, though smaller, are far bolder than the bats of the Llanos. At the time of the expedition of the boundaries, horses from Encaramada, Carichana, and Atures, were conveyed as far as San Jose de Maravitanos, where, on the banks of the Rio Negro, the Portaguese could only procure them, after a long passage, and of a very inferior quality, by the rivers Amazon and Grand Para. Since the year 1795, the cattle of the Jesuits have entirely disappeared. There now remain as monuments of the ancient cultivation of these countries, and the active industry of the first missionaries, only a few trunks of the orange and tamarind, in the savannahs, sarrounded by wild trees.

The tigers, or jaguars, which are less dangerous for the cattle than the bats, come into the village at Atures, and devour the swine of the poor Indians. The missionary related to us a striking instance of the familiarity of these animals, usually so ferocious. Some months before our
arrival, a jaguar, which was thought to be young, though of a large size, had wounded a child in playing with him. The facts of this case, which were verified to us on the spot, are not without interest in the history of the manners of animals. Two Indian children, a boy and a girl, about eight and nine years of age, were seated on the grass near the village of Atures, in the middle of a savannah, which we several times traversed. At two o'clock in the afternoon, a jaguar issued from the forest, and approached the children, bounding around them; sonetimes he hid himself in the high grass, sometimes he sprang forward, his back bent, his head hung down, in the manner of our cats. The little boy, ignorant of his danger, seemed to be sensible of it only when the jaguar with one of his paws gave him some blows on the head. These blows, at first slight, became ruder and ruder; the claws of the jaguar wounded the child, and the blood flowed freely. The little girl then took a branch of a tree, struck the animal, and it fled from her. The Indians ran up at the cries of the children, and saw the jaguar, which then bounded off without making the least show of resistance.

The little boy was brought to us, who appeared lively and intelligent. The claw of the jaguar had torn away the skin from the lower part of the forehead, and there was a second scar at the top of the head. This was a singular fit of playfulness in an animal which, though not difficult to be tamed in our menageries, nevertheless shows itself always wild and ferocious in its natural state. If we admit that, being sure of its prey, it played with the little Indian as our cats play with birds whose wings have been clipped, how shall we explain the patience of a jaguar of large size, which finds itself attacked by a girl? If the jaguar were not pressed by hunger, why did it approach the children at all? There is something mysterious in the affections and hatreds of animals. We have known lions kill three or four dogs that were put into their den, and instantly caress a fifth, which, less timid, took the king of animals by the mane. These are instincts of which we know not the secret.

We have mentioned that domestic pigs are attacked by the jaguars. There are in these countries, besides the
common swine of European race, several species of peccaries, or pigs with lumbar glands, two of which only are known to the naturalists of Europe. The Indians call the little peccary (Dicotiles torquatus, Cuv.), in the Maypure tongue, chacharo; while they give the name of apida to a species of pig which they say has no pouch, is larger, and of a dark brown colour, with the belly and lower jaw white. The chacharo, reared in the houses, becomes tame like our sheep and goats. It reminds us, by the gentleness of its manners, of the curious analogies which anatomists have observed between the peccaries and the ruminating animals. The apida, which is domesticated like our swine in Europe, wanders in large herds composed of several hundreds. The presence of these herds is announced from afar, not only by their hoarse gruntings, but above all by the impetuosity with which they break down the shrubs in their way. M. Bonpland, in an herborizing excursion, warned by his Indian guide to hide himself behind the trunk of a tree, saw a number of these peccaries (cochinos or puercos del monte) pass close by him. The herd marched in a close body, the males proceeding first; and each sow was accompanied by her young. The flesh of the chacharo is flabby, and not very agreeable; it affords, however, a plentiful nourishment to the natives, who kill these animals with small lances tied to cords. We were assured at Atures, that the tiger dreads being surrounded in the forests by these herds of wild pigs; and that, to avoid being stifled, he tries to save himself by climbing up a tree. Is this a hunter's tale, or a fact that has really been observed? In several parts of America the hunters believe in the existence of a javali, or native boar with tusks curved outwardly. I never saw one, but this animal is mentioned in the works of the Spanish missionaries, a source too much neglected by zoologists; for amidst much incorrectness and extravagance, they contain many curious local observations.

Among the monkeys which we saw at the mission of the Atures, we found one new species, of the tribe of sais and sajous, which the Creoles vulgarly call machis. It is the oxavapavi with grey hair and a bluish face. It has the crbits of the eyes and the forehead as white as snow, a peculiarity which at first sight distinguishes it from the

Simis capucina, the Simia apella, the Simia trepida, and the: other weeping monkeys hitherto so confusedly described. This little animal is as gentle as it is ugly. A monkey of this species, which was kept in the courtyard of the missionary, would frequently mount on the back of a pig, and in this manner traverse the savannahs. We have also seen it upon the back of a large cat, which had been brought up with it in Father Zea's house.

It was among the cataracts that we began to hear of the hairy man of the woods, called salvaje, that carries off women, constructs huts, and sometimes eats human flesh. The Tamanacs call it achi, and the Maypures vasitri, or 'great devil.' The natives and the missionaries have no doubt of the existence of this man-shaped monkey, of which they entertain a singular dread. Father Gili gravely relates the history of a lady in the town of San Carlos, in the Llanos of Venezuela, who much praised the gentle character and attentions of the man of the woods. She is stated to have lived several years with one in great domestic harmony, and only requested some hunters to take her back, "because she and her children (a little hairy also) were weary of living far from the church and the sacraments." The same author, notwithstanding his credulity, acknowledges that he never knew an Indian who asserted positively that he had seen the salvaje with his own eyes. This wild legend, which the missionaries, the European planters, and the negroes of Africa, have no doubt embellished with many features taken from the description of the manners of the orang-otang," the gibbon, the jocko or chimpanzee, and the pongo, followed us, during five years, from the northern to the southern hemisphere. We were everywhere blamed, in the most cultivated class of society, for being the only persons to doubt the existence of the great anthropomorphous

- Simia satyrus. We must not believe, notwithstanding the assertions of almost all zoological writers, that the word orang-otang is applied exclusively in the Malay language to the Simia satyrus of Borneo. This expression, on the contrary, means any very large monkey, that resembles man in figure. (Marsden's Hist. of Sumatra, 3rd edit., p. 117.) Modern zoologists have arbitrarily appropriated provincial names to certain species; and by continuing to prefer these names, strangely disfigured in their orthography, to the Latin aystematic names, the confusion of the nomen-. clature has been increased.
monkey of America. There are certain regions where this belief is partieularly prevalent among the people; euch are the banks of the Upper Orinoco, the valley of Upar near the lake of Maracaybo, the mountains of Santa Martha and of Merida, the provinces of Quixos, and the banks of the Amazon near Tomependa. In all these places, so distant one from the other, it is asserted that the salvaje is easily reeognized by the traces of its feet, the toes of which are turned backward. But if there exist a monkey of a large size in the New Continent, how has it happened that for three centuries no man worthy of belief has been able to procure the skin of one? Several hypotheses present themselves to the mind, in order to explain the source of so ancient an error or belief. Has the famous capuchin monkey of Esmeralda (Simia chiropotes), with its long canine. teeth, and physiognomy much more like man's* than that of the orang-otang, given rise to the fable of the salvaje? It is not so large indeed as the coaita (Simia paniscus); but when seen at the top of a tree, and the head only visible, it might easily be taken for a human being. It may be also (and this opinion appears to me the most probable) that the ' man of the woods' was one of those large bears, the footsteps of which resemble those of a man, and which are believed in every country to attack women. The animal killed in my time at the foot of the mountains of Merida, and sent, by the name of salvaje, to Colonel Ungaro, the governor of the province of Varinas, was in fact a bear with black and smooth fur. Our fellow-traveller, Don Nicolas Soto, had examined it closely. Did the strange idea of a plantigrade animal, the toes of which are placed as if it walked backward, take its origin from the habit of the real savages of the woods, the Indians of the weakest and most timid tribes, of deceiving their enemies, when they enter a forest, or cross a sandy shore, by covering the traces of their feet with sand, or walking backward?

Though I have expressed my doubts of the existence of an unknown species of large monkey in a continent which appears entirely destitute of quadrumanous animals of the family of the orangs, cynocephali, mandrils, and pongos; yet

[^268]it should be remembered that almost all matters of popular belief, even those most absurd in appearance, rest on real facts, but facts ill observed. In treating them with disdain, the traces of a discovery may often be lost, in natural philosophy as well as in zoology. We will not then admit, with a Spanish author, that the fable of the 'man of the woods' was invented by the artifice of Indian women, who pretended to have been carried off, when they had been long absent unknown to their husbands. Travellers who may hereafter visit the missions of the Orinoco will do well to follow up our researches on the salvaje or great devil of the woods; and examine whether it be some unknown species of bear, or some very rare monkey analogous to the Simis chiropotes, or Simia satanas, which may have given rise to such singular tales.

After having spent two days near the cataract of Atures, we were not sorry when our boat was reladen, and we were enabled to leave a spot where the temperature of the air is generally by day twenty-nine degrees, and by night twenty-six degrees, of the centigrade thermometer. This temperature seemed to us to be still much more elevated, from the feeling of heat which we experienced. The want of concordance between the instruments and the sensations must be attributed to the continual irritation of the skin excited by the mosquitos. An atmosphere filled with venomous insects always appears to be more heated than it is in reality. We were horribly tormented in the day by mosquitos and the jejen, a small venomous fly (simulium), and at night by the zancudos, a large species of gnat, dreaded even by the natives. Our hands began to swell considerably, and this swelling increased daily till our arrival on the banks of the Temi. The means that are employed to escape from these little plagues are very extraordinary. The good missionary Bernardo Zea, who passed his life tormented by mosquitos, had constructed near the church, on a scaffolding of trunks of palm-trees, a small apartment, in which we breathed more freely. To this we went up in the evening, by means of a ladder, to dry our plants and write our journal. The missionary had justly observed, that the insects abounded more particularly in the lowest strata of the atmosphere, that which reaches from the
ground to the height of twelve or fifteen feet. At Maypures the Indians quit the village at night, to go and sleep on the little islets in the midst of the cataracts. There they enjoy some rest; the mosquitos appearing to shun air loaded with vapours. We found everywhere fewer in the middle of the river than near its banks; and thus less is suffered in descending the Orinoco than in going up in a boat.

Persons who have not navigated the great rivers of equinoctial America, for instance, the Orinoco and the Magdalena, can scarcely conceive how, at every instant, without intermission, you may be tormented by insects flying in the air; and how the multitude of these little animals may render vast regions almost uninhabitable. Whatever fortitude be exercised to endure pain without complaint, whatever interest may be felt in the objects of scientific research, it is impossible not to be constantly disturbed by the mosquitos, zancudos, jejens, and tempraneros, that cover the face and hands, pierce the clothes with their long needle-formed suckers, and getting into the mouth and nostrils, occasion coughing and sneezing whenever any attempt is made to speak in the open air. In the missions of the Orinoco, in the villages on the banks of the river, surrounded by immense forests, the plaga de las moscas, or the plague of the mosquitos, affords an inexhaustible subject of conversation. When two persons meet in the morning, the first questions they address to each other are: "How did you find the zancudos during the night? How are we to-day for the mosquitos?"* These questions remind us of a Chinese form of politeness, which indicates the ancient state of the country where it took birth. Salutations were made heretofore in the Celestial empire in the following words, vou-to-hou, "Have you been incommoded in the night by the serpents?"

The geographical distribution of the insects of the family of tipulm presents very remarkable phenomena. It does not appear to depend solely on heat of climate, excess of humidity, or the thickness of forests, but on local cir-

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cumetances that are difficult to characterise. It may be observed that the plague of mosquitos and zancudos is not so general in the torrid zone as is commonly believed. On the table-lands elevated more than four hundred toises above the level of the ocean, in the very dry plains remote from the beds of great rivers (for instance, at Cumana and Calabozo), there are not sensibly more gnats than in the most populous parts of Europe. They are perceived to augment enormously at Nueva Barcelona, and more to the west, on the coast that extends towards Cape Codera. Between the little harbour of Higuerote and the mouth of the Rio Unare, the wretched inhabitants are accustomed to stretch themselves on the ground, and pass the night buried in the sand three or four inches deep, learing out the head only, which they cover with a handkerchief. You suffer from the sting of insects, but in a manner easy to bear, in descending the Orinoco from Cabruta towards Angostura, and in going up from Cabruta towards Uruana, between the latitudes of $7^{\circ}$ and $8^{\circ}$. But beyond the mouth of the Rio Arauca, after having passed the strait of Baraguan, the scene suddenly changes. From this spot the traveller may bid farewell to repose. If he have any poetical remembrance of Dante, he may easily imagine he has entered the città dolente, and he will seem to read on the granite rocks of Baraguan these lines of the Inferno :Noi sem venati al luogo, ov' i' t'ho detto Che tu vedrai le genti dolorose.
The lower strata of air, from the surface of the ground to the height of fifteen or twenty feet, are absolutely filled with venomous insects. If in an obscure spot, for instance in the grottos of the cataracts formed by superincumbent blocks of granite, you direct your eyes toward the opening enlightened by the sun, you see clouds of mosquitos more or less thick. At the mission of San Borja, the suffering from mosquitos is greater than at Carichana; but in the Raudales, at Atures, and above all at Maypures, this suffering may be said to attain its maximum. I doubt whether there be a country upon earth where man is exposed to more cruel torments in the rainy season. Having passed the fifth degree of latitude, you are somewhat less stung; but on the Upper Orinoco the stings are more painful, because the heat and the abso-
lute want of wind render the air more burning and more irritating in its contact with the skin.
"How comfortable must people be in the moon!" said a Salive Indian to Father Gumilla; "she looks so beautiful and so clear, that she must be free from mosquitos." These words, which denote the infancy of a people, are very remarkable. The satellite of the earth appears to all savage nations the abode of the blessed, the country of abundance. The Esquimaux, who counts among his riches a plank or trunk of a tree, thrown by the currents on a coast destitute of vegetation, sees in the moon plains covered with forests; the Indian of the forests of Orinoco there beholds open savannahs, where the inhabitants are never stung by mosquitos.

After proceeding further to the south, where the system of yellowish-brown waters commences,* on the banks of the Atabapo, the Tuni, the Tuamini, and the Rio Negro, we enjoyed an unexpected repose. These rivers, like the Orinoco, cross thick forests, but the tipulary insects, as well as the crocodiles, shun the proximity of the black waters. Possibly these waters, which are a little colder, and chemically different from the white waters, are adverse to the larvm of tipulary insects and gnats, which may be considered as real aquatic animals. Some small rivers, the colour of which is deep blue, or yellowish-brown (as the Toparo, the Mataveni, and the Zama), are exceptions to the almost general rule of the absence of mosquitos over the black waters. These three rivers swarm with them; and the Indians themselves fixed our attention on the problematic causes of this phenomenon. In going down the Rio Negro, we breathed freely at Maroa, Daripe, and San Carlos, villages situated on the boundaries of Brazil. But this improvement of our situation was of short continuance; our sufferings recommenced as soon as we entered the Cassiquiare. At Esmeralda, at the eastern extremity of the Upper Orinoco, where ends the known world of the Spaniards, the clouds of mosquitos are almost as thick as at the Great Cataracts. At Mandavaca we found an old missionary, who told us with an air of sadness, that he had had "his twenty years of mosquitos" in America.

[^270]He desired us to look at his legs, "that we might be able to tell one day, beyond sea (por allá), what the poor monks suffer in the forests of Cassiquiare." Every sting leaving a small darkish brown point, his legs were so speckled that it was difficult to recognize the whiteness of his skin through the spots of coagulated blood. If the insects of the genus Simulium abound in the Cassiquiare, which has white waters, the culices or zancudos are so much the more rare; you scarcely find any there; while on the rivers of black waters, in the Atabapo and the Rio, there are generally some zancudos and no mosquitos.

I have just shown, from my own observations, how much the geographical distribution of venomous insects varies in this labyrinth of rivers with white and black waters. It were to be wished that a learned entomologist could study on the spot the specific differences of these noxious insects,* which in the torrid zone, in spite of their minute size, act an important point in the economy of nature. What appeared to us very remarkable, and is a fact known to all the missionaries, is, that the different species do not associate together, and that at different hours of the day you are stung by distinct species. Every time that the scene changes, and, to use the simple expression of the missionaries, other insects 'mount guard,' you have a few minutes, often a quarter of an hour, of repose. The insects that disappear have not their places instantly supplied by their successors. From half-past-six in the morning till five in the afternoon, the air is filled with mosquitos; which have not, as some travellers have stated, the form of our gnats, $\dagger$ but that of a small fly. They are simuliums of the family Nemocera of the system of Latreille. Their sting is as painful as that of the genus Stomox. It leaves a little reddish brown spot, which is extravased and coagulated blood, where their proboscis has pierced the skin. An hour before sunset

[^271]a species of small gnats, called tempraneros," because they appear also at sunrise, take the place of the mosquitos. Their presence scarcely lasts an hour and a half; they disappear between six and seven in the evening, or, as they say here, after the Angelus (a la oracion). After a few minutes' repose, you feel yourself stung by zancudos, another species of gnat with very long legs. The zancudo, the proboscis of which contains a sharp-pointed sucker, causes the most acute pain, and a swelling that remains several weeks. Its hum resembles that of the European gnat, but is louder and more prolonged. The Indians pretend to distinguish the zancudos and the tempraneros "by their song;" the latter are real twilight insects, while the zaucudos are most frequently nocturnal insects, and disappear toward sunrise.

In our way from Carthagena to Santa Fé de Bogotá, we observed that between Mompox and Honda, in the valley of the Rio Magdalena, the zancudos darkened the air from eight in the evening till midnight; that towards midnight they diminished in number, and were hidden for three or four hours; and lastly that they returned in crowds, about four in the morning. What is the cause of these alternations of motion and rest? Are these animals fatigued by long flight? It is rare on the Orinoco to see real gnats by day; while at the Rio Magdalena we were stung night and day, except from noon till about two o'clock. The zancudos of the two rivers are no doubt of different species.

We have seen that the insects of the tropics everywhere follow a certain standard in the periods at which they alternately arrive and disappear. At fixed and invariable hours, in the same season, and the same latitude, the air is peopled with new inhabitants, and in a zone where the barometer becomes a clock,* where everything proceeds with such admirable regularity, we might guess blindfold the hour of the day or night, by the hum of the insects, and by their stings,

[^272]the pain of which differs according to the nature of the poison that each species deposits in the wound.

At a period when the geography of animals and of plants had not yet been studied, the analogous species of different climates were often confounded. It was believed that the pines and ranunculuses, the stags, the rats, and the tipulary insects of the north of Europe, were to be found in Japan, on the ridge of the Andes, and at the Straits of Magellan. Justly celebrated naturalists have thought that the zancudo of the torrid zone was the gnat of our marshes, become more vigorous, more voracious, and more noxious, under the influence of a burning climate. This is a very erroneous opinion. I carefully examined and described upon the spot those zancudos, the stings of which are most tormenting. In the rivers Magdalena and Guayaquil alone there are five distinct species.

The culices of South America have generally the wings, corslet, and legs of an azure colour, ringed and variegated with a mixture of spots of metallic lustre. Here as in Europe, the males, which are distinguished by their feathered antennæ, are extremely rare; you are seldom stung except by females. The preponderance of this sex explains the immense increase of the species, each female laying several hundred eggs. In going up one of the great rivers of America, it is observed, that the appearance of a new species of culex denotes the proximity of a new stream flowing in. I shall mention an instance of this curious phenomenon. The Culex lineatus, which belongs to the Caño Tamalamec, is only perceived in the valley of the Rio Grande de la Magdalena, at a league north of the junction of the two rivers; it goes up, but scarcely ever descends the Rio Grande. It is thus, that, on a principal vein, the appearance of a new substance in the gangue indicates to the miner the neighbourhood of a secondary vein that joins the first.

On recapitulating the observations here recorded, we see, that within the tropics, the mosquitos and zancudos do not rise on the slope of the Cordilleras* toward the temperate

[^273]region, where the mean heat is below $190^{\circ}$ or $20^{\circ}$; and that, with few exceptions, they shun the black waters, and dry and unwooded spots." The atmosphere swarms with them much more in the Upper than in the Lower Orinoco, because in the former the river is surrounded with thick forests on its banks, and the skirts of the forests are not separated from the river by a barren and extensive beach. The mosquitos diminish on the New Continent with the diminution of the water, and the destruction of the woods; but the effects of these changes are as slow as the progress of cultivation. The towns of Angostura, Nueva Barcelona, and Mompox, where from the want of police, the streets, the great squares, and the interior of court-yards are overgrown with brushwood, are sadly celebrated for the abundance of zancudos.

People born in the country; whether whites, mulattoes, negroes, or Indians, all suffer from the sting of these insects. But as cold does not render the north of Europe uninhabitable, so the mosquitos do not prevent men from dwelling in the countries where they abound, provided that, by their situation and government, they afford resources for agrieulture and industry. The inhabitants pass their lives in complaining of the insufferable torment of the mosquitos, yet, notwithstanding these continual complaints, they seek, and even with a sort of predilection, the commercial towns of Mompox, Santa Marta, and Rio de la Hacha. Such is the force of habit in evils which we suffer every hour of the day, that the three missions of San Borja, Atures, and Esmeralda; where, to make use of an hyperbolical expression of the monks, "there are more mosquitos than air,"* would no doubt become flourishing towns, if the Orinoco afforded planters the same advantages for the exchange of produce, as the Ohio and the Lower Mississippi.

It is a curious fact, that the whites born in the torrid zone may walk barefoot with impunity, in the same apart-

[^274]ment where a European recently landed is exposed to the attack of the nigua or chegoe (Pulex penetrans). This animal, almost invisible to the eye, gets under the toe-nails, and there acquires the size of a small pea, by the quick increase of its eggs, which are placed in a bag under the belly of the insect. The nigua therefore distinguishes what the most delicate chemical analysis could not distinguish, the cellular membrane and blood of a European from those of a creole white. The mosquitos, on the contrary, attack equally the natives and the Europeans; but the effects of the sting are different in the two races of men. The same venomous liquid, deposited in the skin of a copper-coloured man of Indian race, and in that of a white man newly landed, causes no swelling in the former, while in the latter it produces hard blisters, greatly inflamed, and painful for several days; so different is the action on the epidermis, according to the degree of irritability of the organs in different races and different individuals!
I shall here recite several facts, which prove that the Indians, and in general all the people of colour, at the moment of being stung, suffer like the whites, although perhaps with less intensity of pain. In the day-time, and even when labouring at the oar, the natives, in order to chase the insects, are continually giving one another smart slaps with the palm of the hand. They even strike themselves and their comrades mechanically during their sleep. The violence of their blows reminds one of the Persian tale of the bear that tried to kill with his paw the insects on the forehead of his sleeping master. Near Maypures we saw some young Indians seated in a circle and rubbing cruelly each others' backs with the bark of trees dried at the fire. Indian women were occupied, with a degree of patience of which the copper-coloured race alone are capable, in extracttracting, by means of a sharp bone, the little mass of coagulated blood that forms the centre of every sting, and gives the skin a speckled appearance. One of the most barbarous nations of the Orinoco, that of the Ottomacs, is acquainted with the use of mosquito-curtains (mosquiteros) woven from the fibres of the moriche palm-tree. At Higuerote, on the coast of Caracas, the copper-coloured people sleep buried in the sand. In the villages of the Rio Magdalena
the Indians often invited us to stretch ourselves as they did on ox-skins, near the church, in the middle of the plaza grande, where they had assembled all the cows in the neighbourhood. The proximity of cattle gives some repose to man. The Indians of the Upper Orinoco and the Cassi quiare, seeing that $M$. Bonpland could not prepare his herbal, owing to the continual torment of the mosquitos, invited him to enter their ovens (hornitos). Thus they call little chambers, without doors or windows, into which they creep horizontally through a very low opening. When they have driven away the insects by means of a fire of wet brushwood, which emits a great deal of smoke, they close the opening of the oven. The absence of the mosquitos is purchased dearly enough by the excessive heat of the stagnated air, and the smoke of a torch of copal, which lights the oven during your stay in it. M. Bonpland, with courage and patience well worthy of praise, dried hundreds of plants, shut up in these hornitos of the Indians.

These precautions of the Indians sufficiently prove that, notwithstanding the different organization of the epidermis, the copper-coloured man, like the white man, suffers from the stings of insects; but the former seems to feel less pain, and the sting is not followed by those swellings which, during several weeks, heighten the irritability of the skin, and throw persons of a delicate constitution into that feverish state which always accompanies eruptive maladies. Whites born in equinoctial America, and Europeans who have long sojourned in the Missions, on the borders of forests and great rivers, suffer much more than the Indians, but infinitely less than Europeans newly arrived. It is not, therefore, as some travellers assert, the thickness of the skin that renders the sting more or less painful at the moment when it is received; nor is it owing to the particular organization of the integuments, that in the Indians the sting is followed by less of swelling and inflammatory symptoms; it is on the nervous irritability of the epidermis that the acuteness and duration of the pain depend. This irritability is augmented by very warm clothing, by the use of alcoholic liquors, by the habit of scratching the wounds, and lastly, (and this physiological observation is the result of my own experience, that of baths repeated at too short
intervals. In places where the absence of crocodiles permits people to enter a river, M. Bonpland and myself observed that the immoderate use of baths, while it moderated the pain of old stings of zancudos, rendered us more sensible to new stings. By bathing more than twice a day, the skin is brought into a state of nervous irritability, of which no idea can be formed in Europe. It would seem as if all feeling were carried toward the integuments.

As the mosquitos and gnats pass two-thirds of their lives in the water, it is not surprising that these noxious insects become less numerous in proportion as you recede from the banks of the great rivers which intersect the forests. They seem to prefer the spots where their metamorphosis took place, and where they go to deposit their eggs. In fact the wild Indians (Indios monteros) experience the greater difficalty in accustoming themselves to the life of the missions, as they suffer in the Christian establishments a torment which they scarcely know in their own inland dwellings. The natives at Maypures, Atures, and Esmeralda, have been seen fleeing to the woods, or, as they say, al monte, solely from the dread of mosquitos. Unfortunately, all the Missions of the Orinoco have been established too near the banks of the river. At Esmeralda the inhabitants assured us that if the village were situated in one of the five plains surrounding the high mountains of Duida and Maraguaca, they should breathe freely, and enjoy some repose. The great cloud of mosquitos (la nube de moscas) to use the expression of the monks, is suspended only over the Orinoco and its tributary streams, and is dissipated in proportion as you remove from the rivers. We should form a very inaccurate idea of Guiana and Brazil, were we to judge of that great forest four hundred leagues wide, lying between the sources of the Madeira and the Lower Orinoco, from the vallies of the rivers by which it is crossed.

I learned that the little insects of the family of the nemocere migrate from time to time like the alouate monkeya, which live in society. In certain spots, at the commencement of the rainy season, different species appear, the sting of which has not yet been felt. We were informed at the Rio Magdalena, that at Simiti no other culex than the jejen was formerly known; and it was then possible to enjoy a
tranquil night's rest, for the jejen is not a nocturnal insect. Since the year 1801, the great blue-winged gnat (Culex cyanopterus) has appeared in such numbers, that the poor inhabitnats of Simiti know not how to procure an undisturbed sleep. In the marshy channels (esteros) of the isle of Baru, near Carthagena, is found a little white fly called cafafi. It is scarcely visible to the naked eye, and causes very painful swellings. The toldos or cottons used for mosquito-curtains, are wetted to prevent the cafafi penetrating through the interstices left by the crossing threads. This insect, happily rare elsewhere, goes up in January, by the channel (dique) of Mahates, as far as Morales. When we went to this village in the month of May, we found there cimulice and zancudos, but no jejens.

The insects most troublesome at Orinoco, or as the Creoles say, the most ferocious (los mas feroces), are those of the great cataracts of Esmeralda and Mandavaca. On the Rio Magdalena the Culex cyanopterus is dreaded, particularly at Mompox, Chiloa, and Tamalameca. At these places this insect is larger and stronger, and its legs blacker. It is difficult to avoid smiling on hearing the missionaries dispute about the size and voracity of the mosquitos at different parts of the same river. In a region the inhabitants of which are ignorant of all that is passing in the rest of the world, this is the favourite subject of conversation. "How I pity your situation!" said the missionary of the Raudales to the missionary of Cassiquiare, at our departure ; "you are alone, like me, in this country of tigers and monkeys; with you fish is still more rare, and the heat more violent; but as for my mosquitos (mias moscas) I can boast that with one of mine I would beat three of yours."

This voracity of insects in certain spots, the fury with which they attack man,* the activity of the venom varying in the same species, are very remarkable facts; which find their analogy, however, in the classes of large animals. The crocodile of Angostura pursues men, while at Neuva Barce-

[^275]lona you may bathe tranquilly in the Rio Neveri amidst these carnivorous reptiles. The jaguars of Maturin, Cumanacoa, and the isthmus of Panama, are timid in comparison of those of the Upper Orinoco. The Indians well know that the monkeys of some valleys are easily tamed, while others of the same species, caught elsewhere, will rather die of hunger than submit to slavery.*

The common people in America have framed systems respecting the salubrity of climates and pathological phenomena, as well as the learned of Europe; and their systems, like ours, are diametrically opposed to each other, according to the provinces into which the New Continent is divided. At the Rio Magdalena the frequency of mosquitos is regarded as troublesome, but salutary. These animals, say the inhabitants, give us slight bleedings, and preserve us, in a country excessively hot, from the scarlet fever, and other inflammatory diseases. But at the Orinoco, the banks of which are very insalubrious, the sick blame the mosquitos for all their sufferings. It is unnecessary to refute the fallacy of the popular belief that the action of the mosquitos is salutary by its local bleedings. In Europe the inhabitants of marshy countries are not ignorant that the insects irritate the epidermis, and stimulate its functions by the venom which they deposit in the wounds they make. Far from diminishing the inflammatory state of the skin, the stings increase it.

The frequency of gnats and mosquitos characterises unhealthy climates only so far as the development and multiplication of these insects depend on the same causes that give rise to miasmata. These noxious animals love a fertile soil covered with plants, stagnant waters, and a humid air never agitated by the wind; they prefer to an open country those shades, that softened day, that tempered degree of

* I might have added the example of the scorpion of Cumana, which it is very difficult to distinguish from that of the island of Trinidad, Jamaica, Carthagena, and Guayaquil ; yet the former is not more to be feared than the Scorpio europæus (of the south of France), while the latter produces consequences far more alarming than the Scorpio occitanus (of Spain and Barbary). At Carthagena and Guayaquil, the sting of the scorpion (alacran) instantly causes the loss of speech. Sometimes a singular torpor of the tongue is observed for fifteen or sixteen hours. The patient, when stung in the legs, stammers as if he had been struck with apoplexy.
light, heat, and moisture which, while it favours the action of chemical affinities, accelerates the putrefaction of organised substances. May not the mosquitos themselves increase the insalubrity of the atmosphere? When we reflect that to the height of three or four toises a cubic foot of air is often peopled by a million of winged insects,* which contain a caustic and venomous liquid; when we recollect that several species of culex are 1.8 line long from the head to the extremity of the corslet (without reckoning the legs); lastly, when we consider that in this swarm of mosquitos and gnats, diffused in the atmosphere like smoke, there is a great number of dead insects raised by the force of the ascending air, or by that of the lateral currents which are caused by the unequal heating of the soil, we are led to inquire whether the presence of so many animal substances in the air must not occasion particular miasmata. I think that these substances act on the atmosphere differently from sand and dust; but it will be prudent to affirm nothing positively on this subject. Chemistry has not yet unveiled the numerous mysteries of the insalubrity of the air; it has only taught us that we are ignorant of many things with which a few years ago we believed we were acquainted.

Daily experience appears in a certain degree to prove the fact that at the Orinoco, Cassiquiare, Rio Caura, and whereever the air is very unhealthy, the sting of the mosquito augments the disposition of the organs to receive the impression of miasmata. When you are exposed day and night, during whole months, to the torment of insects, the continual irritation of the skin causes febrile commotions; and, from the sympathy existing between the dermoid and the gastric systems, injures the functions of the stomach. Digestion first becomes difficult, the cutaneous inflammation excites profuse perspirations, an unquenchable thirst succeds, and, in persons of a feeble constitution, increasing impatience is succeeded by depression of mind, during which all the pathogenic causes act with increased violence. It is neither the dangers of navigating in small boats, the savage Indians, nor the serpents, crocodiles, or jaguars, that make Spaniards dread a voyage on the Orinoco; it is, as

[^276]they sery with simplicity, "el sudar y las moscas," (the perspiration and the flies). We have reason to believe that mankind, as they change the surface of the soil, will succeed in altering by degrees the constitution of the atmosphere. The insects will diminish when the old trees of the forest have disappeared; when, in those countries now desert, the rivers are seen bordered with cottages, and the plains covered with pastures and harvasts.

Whoever has lived long in countries infested by mosquitos will be convinced, as we were, that there exists no remedy for the torment of these insects. The Indians, covered with anoto, bolar earth, or turtle oil, are not protected from their attacks. It is doubtful whether the painting even relieves: it certainly does not prevent the evil. Europeans, recently arrived at the Orinoco, the Rio Magdalena, the river Guayaquil, or Rio Chagres (I mention the four rivers where the insects are most to be dreaded) at first obtain some relief by covering their faces and hands, but they soon feel it difficult to endure the heat, are weary of being condemned to complete inactivity, and finish with leaving the face and hands uncovered. Persons who would renounce all kind of occupation during the navigation of these rivers, might bring some particular garment from Europe in the form of a bag, under which they could remain covered, opening it only every half-hour. This bag should be distended by whalebone hoops, for a close mask and gloves would be perfectly insupportable. Sleeping on the ground, on skins, or in hammocks, we could not make use of mosquito-curtains (toldos) while on the Orinoco. The toldo is useful only where it forms a tent so well closed around the bed that there is not the smallest opening by which a gnat can pass. This is difficult to accomplish; and often when you succeed (for instance, in going up the Rio Magdalens, where you travel with some degree of convenience), you are forced, in order to avoid being suffocated by the heat, to come out from beneath your toldo, and walk about in the open air. A feeble wind, smoke, and powerful smells, scarcely afford any relief in places where the insects are very numerous and very voracious. It is erroneously affirmed that these little animals fly from the peculiar smell emitted by the crocodile. We were fearfully stung at

Bataillez, in the road from Carthagena to Honda, while we were dissecting a crocodile eleven feet long, the smell of which infested all the surrounding atmosphere. The Indians much commend the fumes of burnt cow-dung. When the wind is very strong, and accompanied by rain, the mosquitos disappear for some time: they sting most cruelly at the approach of a storm, particularly when the electric explosions are not followed by heavy showers.

Anything waved about the head and the hands contributes to chase away the insects. "The more you stir yourself, the less you will be stung," say the missionaries. The zancudo makes a buzzing before it settles; but, when it has assumed confidence, when it has once begun to fix its sucker, and distend itself, you may touch its wings without its being frightened. It remains the whole time with its two hind legs raised; and, if left to suck to satiety, no swelling takes place, and no pain is left behind. We often repeated this experiment on ourselves in the valley of the Rio Magdalena. It may be asked whether the insect deposits the stimulating liquid only at the moment of its flight, when it is driven away, or whether it draws the liquid up again when left to suck undisturbed. I incline to this latter opinion; for on quietly presenting the back of my hand to the Culex cyanopterus, I observed that the pain, though violent in the beginning, diminishes in proportion as the insect continues to suck, and ceases altogether when it voluntarily flies away. I also wounded my skin with a pin, and rubbed the pricks with bruised mosquitos, and no swelling ensued. The irritating liquid, in which chemists have not yet recognized any acid properties, is contained, as in the ant and other hymenopterous insects, in particular glands; and is probably too much diluted, and consequently too much weakened, if the skin be rubbed with the whole of the bruised insect.

I have thrown together at the close of this chapter all we learned during the course of our travels on phenomena which naturalists have hitherto singularly neglected, though they exercise a great influence on the welfare of the inhabitants, the salubrity of the climate, and the establishment of new colonies on the rivers of equinoctial America. I might justly have incurred the charge of having treated
this subject too much in detail, were it not connected with general physiological views. Our imagination is struck only by what is great; but the lover of natural philosophy should reflect equally on little things. We have just seen that winged insects, collected in socicty, and concealing in their sucker a liquid that irritates the skin, are capable of rendering vast countries almost uninhabitable. Other insects equally small, the termites (comejen), ${ }^{*}$ create obstacles to the progress of civilization, in several hot and temperate parts of the equinoctial zone, that are difficult to be surmounted. They devour paper, pasteboard, and parchment with frightful rapidity, utterly destroying records and libraries. Whole provinces of Spanish America do not possess one written document that dates a hundred years back. What improvement can the civilization of nations acquire if nothing link the present with the past; if the depositaries of human knowledge must be repeatedly renewed; if the records of genius and reason cannot be transmitted to posterity?

In proportion as you ascend the table-land of the Andes these evils disappear. Man breathes a fresh and pure air. Insects no more disturb the labours of the day or the slumbers of the night. Documents can be collected in archives without our having to complain of the voracity of the termites. Mosquitos are no longer feared at a height of two hundred toises; and the termites, still very frequent at three hundred toises of elevation,* become very rare at Mexico, Santa Fé de Bogotá, and Quito. In these great capitals, situated on the back of the Cordilleras, we find libraries and archives, augmented from day to day by the enlightened zeal of the inhabitants. These circumstances, combined with others, insure a moral preponderance to the Alpine region over the lower regions of the torrid zone. If we admit, agreeably to the ancient traditions collected in both the old and new worlds, that at the time of the catastrophe which preceded the renewal of our species, man descended from the mountains into the plains, we may admit, with still greater confidence, that these mountains,

[^277]the cradle of so many various nations, will for ever remain the centre of human civilization in the torrid zone. From these fertile and temperate table-lands, from these islets scattered in the aërial ocean, knowledge and the blessings of social institutions will be spread over those vast forests extending along the foot of the Andes, now inhabited only by savage tribes whom the very wealth of nature has retained in indolence and barbarism.

## Chapter XXI.

Raudal of Garcita.-Maypures.-Cataracts of Quituna.-Mouth of the Vichada and the Zama.--Rock of Aricagua.-Siquita.

We directed our course to the Puerto de arriba, above the cataract of Atures, opposite the mouth of the Rio Cataniapo, where our boat was to be ready for us. In the narrow path that leads to the embarcadero we beheld for the last time the peak of Uniana. It appeared like a cloud rising above the horizon of the plains. The Guahibos wander at the foot of the mountains, and extend their course as far as the banks of the Vichada. We were shown at a distance, on the right of the river, the rocks that surround the cavern of Ataruipe; but we had not time to visit that cemetery of the destroyed tribe of the Atures. Father Zea had repeatedly described to us this extraordinary cavern, the skeletons painted with anoto, the large vases of baked earth, in which the bones of separate families appear to be collected; and many other curious objects, which we proposed to examine on our return from the Rio Negro. "You will scarcely believe," said the missionaries, "that these skeletons, these painted vases, things which we believed were unknown to the rest of the world, have brought trouble upon me and my neighbour, the missionary of Carichana. You have seen the misery in which I live in the raudales. Though devoured by mosquitos, and often in want of plantains and cassava, yet I have found envious people even in this country! A white man, who inhabits the pastures between the Meta and the Apure, denounced me recently in the Audencia of Caracas, VOI. II.
as concealing a treasare I had discorered, jointly with the missionary of Carichana, amid the tombs of the Indians. It is asserted that the Jesuits of Banta Fé de Bogotá were apprised beforehand of the destruction of their company; and that, in order to save the riches they possessed in money and precious vases, they sent them, either by the Rio Meta or the Viehada, to the Orinoco, with orders to have them hidden in the islets amid the raudales. Theee treasures I am supposed to have appropriated unknown to my superiors. The Audencia of Caracas brought a complaint before the governor of Guiana, and we were ordered to appear in person. We useleasly performed a journey of one hundred and fifty leagues; and, although we declared that we had found in the cavern only human bones, and dried bats and polecats, commissioners were gravely nominated to come hither and search on the spot for the supposed treasures of the Jesuits. We shall wait long for these commissioners. When they have gone up the Orinoco as far as San Borja, the fear of the mosquitos will prevent them from going farther. The cloud of fies thich envelopes us in the raudales is a good defence."

The account given by the missionary was entirely conformable to what we afterwards learned at Angostura from the governor himself. Fortuitous circumstances had given rise to the strangest suspicions. In the caverns where the mummies and skeletons of the nation of the Atures are found, even in the midst of the cataracts, and in the most inaccessible islets, the Indians long ago discovered bores bound with iron, containing various European tools, remnants of clothes, rosaries, and glass trinkets. These objects are thought to have belonged to Portuguese traders of the Rio Negro and Grand Para, who, before the establishment of the Jesuits on the banks of the Orinoco, went up to Atures by the portages and interior communications of rivers, to trade with the natives. It is supposed that these men sunk beneath the epidemic maladies so common in the raudales, and that their cheats became the property of the Indians, the wealthiest of whom were usually buried with all they possessed most valuable during their lives. From these very uncertain traditions the tale of hidden treasures has been fabricated. As in the Andes of Quito every ruined
bailding, not excepting the foundations of the pyramids crected by the French savans for the measurement of the meridian, is regarded as Inga pilca,* that is, the work of the Inca; so on the Orinoco every hidden treasure can belong onty to the Jesuits, an order which, no doubt, governed the missions better than the Capuchins and the monks of the Observance, but whose riches and success in the civilization of the Indians have been much exaggerated. When the Jesuits of Santa Fé were arrested, those heaps of piastres, those emeralds of Muzo, those bars of gold of Choco, which the enemies of the company supposed they possessed, were not found in their dwellings. I can cite a respectable testimony, which proves inconteatibly, that the viceroy of New Granada had not warned the Jesuits of Santa Fé of the danger with which they were menaced. Don Vicente Orosco, an engineer officer in the Spanish army, related to me that, being arrived at Angostara, with Don Manuel Centurion, to arrest the missionaries of Carichana, he met an Indian boat that was going down the Rio Meta. The boat being manned with Indians who could speak none of the tongues of the country, gave rise to suspicions. After useless researches, a bottle was at length discovered, containing a letter, in which the Superior of the company residing at Sruta Fé informed the missionaries of the Orinoco of the persecutions to which the Jesuits were exposed in New Grenada. This letter recommended no measure of precaution; it was short, without ambiguity, and respectful towards the government, whose orders were execated with useless and unreasonable severity.

Eight Indians of Atures had conducted our boat through the raudales, and seemed well satisfied with the slight recompence we gave them. They gain little by this employment; and in order to give a just idea of the poverty and want of commerce in the missions of the Orinoco, I shall observe that during three years, with the exception of the boats sent annually to Angostura by the commander of San Carlos du Rio Negro, to fetch the pay of the soldiers, the misslonary had seen but five canoes of the Upper

* Pilca (properly in Quichua pirca), wall of the Inca.

Orinoco pass the cataract, which were bound for the harvest of turtles' eggs, and eight boats laden with merchandize.

About eleven on the morning of the 17th of April we reached our boat. 'Father Zea caused to be embarked, with our instruments, the small store of provisions he had been able to procure for the voyage, on which he was to accompany us; these provisions consisted of a few bunches of plantains, some cassava, and fowls. Leaving the embarcadero, we immediately passed the mouth of the Cataniapo, a small river, the banks of which are inhabited by the Macos, or Piaroas, who belong to the great family of the Salive nations.

Besides the Piaroas of Cataniapo, who pierce their ears, and wear as ear-ornaments the teeth of caymans and peccaries, three other tribes of Macos are known : one, on the Ventuari, above the Rio Mariata; the second, on the Padamo, north of the mountains of Maraguaca; and the third, near the Guaharibos, towards the sources of the Orinoco, above the Rio Gehette. This last tribe bears the name of Macos-Macos. I collected the following words from a young Maco of the banks of the Cataniapo, whom we met near the embarcadero, and who wore in his ears, instead of a tusk of the peccary, a large wooden cylinder.*

Plantain, Paruru (in Tamanac also, paruru).
Cassava, Elente (in Maco, cahig).
Maize, Niarne.
The sun, Jama (in Salive, mume-seke-cocco).
The moon, Jama (in Salive, vexio).
Water, Ahia (in Salive, cagua).
One, Nianti.
Two, Tajus.
Three, Percotahuja.
Four, Imontegroa.
The young man could not reckon as far as five, which certainly is no proof that the word five does not exist in the Maco tongue. I know not whether this tongue be a dialect of the Salive, as is pretty generally asserted; for idioms
*This custom is observed among the Cabres, the Maypures, and the Pevas of the Amazon. These last, described by La Condamine, stretch their ears by weights of a considerable size.
derived from one another, sometimes furnish words utterly different for the most common and most important things.* But in discussions on mother-tongues and derivative languages, it is not the sounds, the roots only, that are decisive; but rather the interior structure and grammatical forms. In the American idioms, which are notwithstanding rich, the moon is commonly enough called the sun of night, or even the sun of leep; but the moon and sun very rarely bear the same name, as among the Macos. I know only a few examples in the most northerly part of America, among the Woccons, the Ojibbeways, the Muskogulges, and the Mohawks. $\dagger$ Our missionary asserted that jama, in Maco, indicated at the same time the Supreme Being, and the great orbs of night and day; while many other American tongues, for instance the Tamanac, and the Caribbee, have distinct words to denote God, the Moon, and the Sun. We shall soon see how anxious the missionaries of the Orinoco are not to employ, in their translations of the prayers of the church, the native words which denote the Divinity, the Creator (Amanene), the Great Spirit who animates all nature. They choose rather to Indianize the Spanish word Dios, converting it, according to the differences of pronunciation, and the genius of the different dialects, into Dioso, Tiosu, or Piosu.
When we again embarked on the Orinoco, we found the river free from shoals. After a few hours we passed the Raudal of Garcita, the rapids of which are easy of ascent, when the waters are high. To the eastward is seen a small chain of mountains called the chain of Cumadaminari, consisting of gneiss, and not of stratified granite. We were struck with a succession of great holes at more than one hundred and eighty feet above the present level of the Orinoco, yet which, notwithstanding, appear to be the effects of the erosion of the waters. We shall see hereafter, that this phenomenon occurs again nearly at the same height, both in the rocks that border the cataracts of Maypures, and fifty leagues to the east, near the mouth of the Rio Jao.

* The great family of the Esthonian (or Tschoudi) languages, and of the Samoiede languages, affords numerous examples of these differences.
+ Nipia-kisathwa in the Shawanese (the idiom of Canada), from nippi, to sleep, and kisathwa, the sun.

Wo alept in the open air, on the left bank of the river, below the island of Tomo. The night was beantiful and serene, but the torment of the mosquitos was se great near the ground, that I could not succeod in levelling the artifecial horizon; consequently I los the opportunity of making am oberrvation.

On the 18th we set out at three in the moming, to be nore sure of arriving before the close of the day at the cataract known by the name of the Ravodal do los Greahiboe. We stopped at the mouth of the Rio Tomo. The Indisns went on shore, to prepare their food, and take some repose. When we reached the foot of the raudal, it was near five in the afternoon. It was extremely difficult to go up the current against a mass of water, precipitated from a beank of gneiss several feet high. An Indian threw himself into the water, to reach, by swimming, the rock that divides the cataract into two parts. A rope was fastened to the poinats of this rock, and when the canoe was hauled near enough, our instruments, our dry plants, and the provision we had collected at Atures, were landed in the raudal itself. We remarked with surprise, that the natural dam over which the river is precipitated, presents a dry space of comsiderable. extent; where we stopped to see the boat go up.

The rock of gneiss exhibits circular holes, the largest of which are four feet deep, and eighteen inches wide. These funnels contain quartz pebbles, and appear to have beea formed by the friction of masses rolled along by the impulae of the waters. Our situation, in the midst of the cataract, was singular enough, but unattemded by the smallest danger. The missionary, who accompanied us, had his fever-fit on him. In order to quench the thirst by which he was tommented, the idea suggested itself to us of preparing a refreshing beverage for him in one of the excavations of the roek. We had taken on board at Atures an Imdian basket called a mapire, filled with sugar, limes, and those grenadillas, or fruits of the passion-flower, to whieh the Spaniards give the name of purchas. As, we were absolutely destitute of large vessels for holding and mixing liquids, we poured the water of the river, by means of a calabash, into one of the holes of the nock: to this we added sugar and lime-juice. In a few minutes we had an excellent beverage, which is
alment a refinement of lixury, in that wild mpot; but ous wants rendered us every day more and more ingenione.

After an hour of expetation, we saw the boat arrive abore: the raudal, and we were soon ready to depant. After quitting the rock, our passage was not exempt from danger. The river is eight hrundred toises broad, and must be crossed obliquely, above the cataract, at the point where the waterm, inppelled by the slope of their bed, rush with extreme violence toward the ledge from which they are precipitated. We were orertaken by a storm, accompanied happily by no wind, bat the rain fell in torrents. After rowing for twenty minates, the pilot declared, that, far from gaining upon the current, we were again approaching the rasodel. These moments of uncertainty appeared to us very long: the Indians spoke only in whispers, as they do always when they think their situation perilous. They redoebled their effortw, and we arrived at nightfall, withouts any arcident, in the port of Maypures.

Storms within the tropics are as short a they are violent. The lightning had fallen twice near our boat, and had no doubt struck the surface of the water. I mention this phenomenon, because it is pretty generally believed in those countries that the clouds, the murfase of which is charged with eleetricity, are at so great a height that the lightning reaches the ground more rarely than in Curope. The night was extremely dark, and we could not in less than two hours reach the village of Maypures: We were wet to the skin. In proportion as the rain ceased, the zancudos reappeared, with that voracity which tipulary insects always display immediately after a storm. My fellow-travellers were uncertain whether it would be best to stop in the port or proceed on our way on foot, in spite of the darknesm of the night. Father Zea was determined to reach his home. He had given directions for the constraction of a large house of two stories, which was to be begun by the Indians of the mission. "You will there find," said he gravely, ${ }^{c}$ the same conveniences as in the open air; I have neithes a bench nor a table, but you will not suffer so much from the ffies, which are less troublesome in the mission than on the banks of the river." We followed the counsel of the missinnary, who earased torchea of copail to be lighted

Thase torches are tubes made of bark, three inches in diameter, and filled with copal resin. We walked at first over beds of rock, which were bare and slippery, and then we entered a thick grove of palm trees. We were twice obliged to pass a stream on trunks of trees hewn down. The torches had already ceased to give light. Being formed on a strange principle, the woody substance which resembles the wick surrounding the resin, they emit more smoke than light, and are easily extinguished. The Indian pilot, who expressed himself with some facility in Spanish, told us of snakes, water-serpents, and tigers, by which we might be attacked. Such conversations may be expected as matters of course, by persons who travel at night with the natives. By intimidating the European traveller, the Indians imagine they render themselves more necessary, and gain the confidence of the stranger. The rudest inhabitant of the missions fully understands the deceptions which everywhere arise from the relations between men of unequal fortune and civilization. Under the absolute and sometimes veratious government of the monks, the Indian seeks to ameliorate his condition by those little artifices which are the weapons of physical and intellectual weakness.

Having arrived during the night at San Jose de Maypures we were forcibly struck by the solitude of the place; the Indians were plunged in profound sleep, and nothing was heard but the cries of nocturnal birds, and the distant sound of the cataract. In the calm of the night, amid the deep repose of nature, the monotonous sound of a fall of water has in it something sad and solemn. We remained three days at Maypures, a small village founded by Don Jose Solano at the time of the expedition of the boundaries, the situation of which is more picturesque, it might be said still more admirable, than that of Atures.
The raudal of Maypures, called by the Indians Quituna, is formed, as all cataracts are, by the resistance which the river encounters in its way across a ridge of rocks, or a chain of mountains. The lofty mountains of Cunavami and Calitamini, between the sources of the rivers Cataniapo and Ventuari, stretch toward the west in a chain of granitic hills. From this chain flow three small rivers, which embrace in some sort the cataract of Maypures. There are, on
the eastern bank; the Sanariapo, and on the western, the Cameji and the Toparo. Opposite the village of Maypures, the mountains fall back in an arch, and, like a rocky coast, form a gulf open to the south-east. The irruption of the river is effected between the mouths of the Toparo and the Sanariapo, at the western extremity of this majestic amphitheatre.
The waters of the Orinoco now roll at the foot of the eastern chain of the mountains, and have receded from the west, where, in a deep valley, the ancient shore is easily recognized. A savannah, scarcely raised thirty feet above the mean level of the river, extends from this valley as far as the cataracts. There the small church of Maypures has been constructed. It is built of trunks of palm-trees, and is surrounded by seven or eight huts. The dry valley, which runs in a straight line from south to north, from the Cameji to the Toparo, is filled with granitic and solitary mounds, all resembling those found in the shape of islands and shoals in the present bed of the river. I was struck with this amalogy of form, on comparing the rocks of Keri and Oco, situated in the deserted bed of the river, west of Maypures, with the islets of Ouivitari and Caminitamini, which rise like old castles amid the cataracts to the east of the mission. The geological aspect of these scenes, the insular form of the elevations farthest from the present shore of the Orinoco, the cavities which the waves appear to have hollowed in the rock Oco, and which are precisely on the same level (twentyfive or thirty toises high) as the excavations perceived opposite to them in the isle of Ouivitari; all these appearances prove that the whole of this bay, now dry, was formerly covered by water. Those waters probably formed a lake, the northern dike preventing their running out: but, when this dike was broken down, the savannah that surrounds the mission appeared at first like a very low island, bounded by two arms of the same river. It may be supposed that the Orinoco continued for some time to fill the ravine, which we shall call the valley of Keri, because it contains the rock of that name; and that the waters retired wholly toward the eastern chain, leaving dry the western arm of the river, only as they gradually diminished. Coloured stripes, which no doubt owe their black tint to the oxides of iron and
manganese, reem to justify this comjecture. They arc foumal on all the utoness far from the mission, and indicate the farmer abode of the waters. In going wp the river, all merchandise is diseharged at the confluence of the $\mathrm{H}_{\mathrm{i}}$ Toparo and the Orinoco. The boats are entrusted to the natives, who have so perfect a knowledge of the raudal, that they have a particular name for every step. They comduct the boats as far as the mouth of the Cameji, where the danger is considered as past.

I will here describe the cataract of Quituma or Mayparer an it appeared at the two periods when I examined in, in going down and up the river. It is formed, like that of Mapara or Atures, by an archipelago of islands, which, to the length of three thoussand toises, fill the bed of the river; and by rocky dikes, which join the islamels together. The most remarkable of these dikes, or natural dams, are Puis marimi, Manimi, and the Leap of the Sardine (Salto de ly Sardina). I name them in the order in which I saw thesen in succession from south to morth. The last of these threa stages is near nine feet high, and forms by its breadth a magnificent cascade. I must here repeat, however, that the turbulent shock of the precipitated and broken waters depends not so much on the absolute height of each step or dike, as upon the multitude of counter-cumrents, the grouping of the islands and eshoals, that lie at the foot of the raudalitos or partial cascades, and the contraction of the channels, which often do not leave a free navigable passage of twenty or thirly feet. The eastern part of the catarget of Maypures is much more dangerous than the westerm; and therefore the Indian pilots prefer the left bank of the river to conduct the boats down or up. Unfortumately, in the season of low waters, this bank remains partly dry, and recourse must be had to the process of portage; that is, the boats are obliged to be dragged on cylinders, or round loge

To command a comprehensive view of these stupendoua seenes, the spectator naust be stationed on the little mountsin of Manimi, a granitic ridge, which rises from the savannah, north of the church of the mission, and is itself only a continuation of the ridges of which the raudalito of Manimi is composed. We often visited this mountain, fare we were never weary of gazing on this astonishing spectacle.

From: the summit of the rock is descried a sheet of form; extending the length of a whole mile. Fnormoun masees of stome, black as iron, issue from its bosom. Some are papa grouped in pairs, like basaltie bills; others resemble towers, fortified enstles, and ruined buildings. Their gloomy timt contrasts with the silvery splendour of the foam. Brery roek, every islet is covered with vigorous trees, collected in clasters. At the foot of those paps, far as the eye can reach, a thick rapour is suspended over the river, and through this whitish fog the tops of the lofty palm-trees shoot up. What: name shall we give to these majestic plants? I suppose them to be the vadgriai, a new speeies of the genus Oreodaxa, the trunk of which is more than eighty feet high. The feathery leaves of this palm-tree have a brilliant lustre, and rise: almost straight toward the sky. At every hour of the day the sheet of foam displays different aspects. Sometimes the hilly islands and the palm-trees project their broad shadows; sometimes the rays of the setting san are refracted in the clowd that hangs over the cataract, and coloured arcs amer formed which vanish and appear alternately.

Such is the character of the landscape discovered from the top of the mountain of Manimi, which no traveller has yet deseribed. I do not hesitate to repeat, that neither time; nor the view of the Cordilleras, nor any abode in the temperate vallies of Mexico, has effaced from my mind the powerful impression of the aspect of the cataracts. When I read a description of those places in India that are ember. lished by running waters amd a vigorous vegetation, my imagimation retraces a sea of foam and palm-trees, the topas of which rise above a stratum of vapour. The majestic scenes of nature, like the sublime works of poetry and the arts, leave remembranees that are incessantly awakening and which, through the whole of life, mingle with all out. feelings of what is grand and beautiful.

The calm of. the atmosphere, and the tamultaous morement of the waters, produce a contrast peculiar to this zome: Here no breath of wind ever agitates the foliage, no cloud veils the splendour of the azure vault of heaven; a great mass of light is diffused in the air, on the earth strewn with plants with glosey leares, and on the bed of the river, whicte extends as far as: the eye can reach. This appearance mam
prises the traveller born in the north of Europe. The idea of wild scenery, of a torrent rushing from rock to rock, is linked in his imagination with that of a climate where the noise of the tempest is mingled with the sound of the cataract; and where, in a gloomy and misty day, sweeping clouds seem to descend into the valley, and to rest upon the tops of the pines. The landscape of the tropics in the low regions of the continents has a peculiar physiognomy, something of greatness and repose, which it preserves even where one of the elements is struggling with invincible obstacles. Near the equator, hurricanes and tempests belong to islands only, to deserts destitute of plants, and to those spots where parts of the atmosphere repose upon surfaces from which the radiation of heat is very unequal.

The mountain of Manimi forms the eastern limit of a plain which furnishes for the history of vegetation, that is, for its progressive development in bare and desert places, the same phenomena which we have described above in speaking of the raudal of Atures. During the rainy season, the waters heap vegetable earth upon the granitic rock, the bare shelves of which extend horizontally. These islands of mould, decorated with beautiful and odoriferous plants, resemble the blocks of granite covered with flowers, which the inhabitants of the Alps call gardens or courtils, and which pierce the glaciers of Switzerland.
In a place where we had bathed the day before, at the foot of the rock of Manimi, the Indians killed a serpent seven feet and a-half long. The Macos called it a camudu. Its back displayed, upon a yellow ground, transverse bands, partly black, and partly inclining to a brown green: under the belly the bands were blue, and united in rhombic spots. This animal, which is not venomous, is said by the natives to attain more than fifteen feet in length. I thought at first, that the camudu was a boa; but I saw with surprise, that the scales beneath the tail were divided into two rows. -It was therefore a viper, (coluber); perhaps a python of the New Continent: I say perhaps, for great naturalists appear to admit that all the pythons belong to the Old, and all the boas to the New World. As the boa of Pliny was a serpent of Africa and of the south of Europe, it would have been well if the boas of America had been named pythons,
and the pythons of India been called boas. The first notions of an enormous reptile capable of seizing man, and even the great quadrupeds, came to us from India and the coast of Guinea. However indifferent names may be, we can scarcely admit the idea, that the hemisphere in which Virgil described the agonies of Laocoon, (a fable which the Greeks of Asia borrowed from much more southern nations) does not possess the boa-constrictor. I will not augment the confusion of zoological nomenclature by proposing new changes, and shall confine myself to observing that at least the missionaries and the latinized Indians of the missions, if not the planters of Guiana, clearly distinguish the tragavenados (real boas, with simple anal plates) from the culebras de agua, or water-snakes, like the camudus (pythons with double anal scales). The traga-venados have no transverse bands on the back, but a chain of rhombic or hexagonal spots. Some species prefer the driest places; others love the water, as the pythons, or culebras de agua.

Advancing towards the west, we find the hills or islets in the deserted branch of the Orinoco crowned with the same palm-trees that rise on the rocks of the cataracts. One of these hills, called Keri, is celebrated in the country. on account of a white spot which shines from afar, and in which the natives profess to see the image of the full moon. I could not climb this steep rock, but I believe the white spot to be a large nodule of quartz, formed by the union of several of those veins so common in granites passing into gneiss. Opposite Keri, or the Rock of the Moon, on the twin mountain Ouivitari, which is an islet in the midst of the cataracts, the Indians point out with mysterious awe a similar white spot. It has the form of a dise; and they say this is the image of the sun (Camosi). Perhaps the geographical situation of these two objects has contributed to their having received these names. Keri is on the side of the setting, Camosi on that of the rising sun. Languages being the most ancient historical monuments of nations, some learned men have been singularly struck by the analogy between the American word camosi and camosch, which seems to have signified originally, the sun, in one of the Semitic dialects. This analogy has given rise to hypotheses
which appear to me at least very problematical. The god of the Moabites, Chemosh, or Camosch, who has so wearied the patience of the learned; Apollo Chomens, cited by Strabo and by Ammianus Marcellinus; Belphegor; Amun or Hamon; and Adonis: all, without doubt, represent the sun in the winter solstice; but what can we conclude from a solitary and fortuitous resemblance of sounds in languages that have nothing besides in common?

The Maypure tongue is still spoken at Atures, although the mission is inhabited only by Guahibos and Macos. At Maypures the Guareken and Pareni tongues only are now spoken. From the Rio Anaveni, which falls into the Orinoco north of Atures, as far as beyond Jao, and to the mouth of the Guaviare (between the fourth and sixth degrees of latitude), we everywhere find rivers, the termimation of which, veni,* recalls to mind the extent to which the Maypure tongue heretofore prevailed. Veni, or woeni, signifies water, or a river. The words camosi and keri, which we have just cited, are of the idiom of the Pareni Indians, $t$ who, I think I have heard from the natives, lived originally on the banks of the Mataveni. $\ddagger$ The Abbé Gili considers the Pareni as a simple dialect of the Maypure. This question cannot be solved by a comparison of the roots merely. Being totally ignorant of the grammatical structure of the Pareni, I can raise but feeble doubts against the opinion of the Italian missionary. The Pareni is perhaps a mixture of two tongues that belong to different families; like the Maquiritari, which is composed of the Maypure and the Caribbee; or, to cite an example better known, the modern Persian, which is allied at the same time to the Sanscrit and to the Semitic tongues. The

[^278]following are Pareni words, which I carefully compared with Maypure words.*

|  | Pareni tonaus. | maypure tongote |
| :---: | :---: | :---: |
| The sun | Camosi | Kiè (Kieparig) |
| The mon | Keri | Kejapi (Cagijapi) |
| A star | Ouipo | Urrapu |
| The devil | Amethami | Vasuri |
| Water | Onemi (At) | Oueni |
| Fire | Cagi | Cati |
| Lightning | Eno | Eno-ima $\dagger$ |
| The head | Ossipe | Nuchibucu $\ddagger$ |
| The hair | Nomao 4 |  |
| The eyes | Noparizi | Nupuriki |
| The nose | Nosivi | Nukirri |
| The moath | Nonoma | Nunumaca |
| The teeth | Naxi | 法矿 |
| The tongue | Notate | Nuare |
| The ear | Notasine | Nakkini |
| The cheek | Nocaco |  |
| The neck | Nono | Noing |
| The mam | Nocamo | Nuana |
| The hand | Nucavi | Nucapi |
| The breast | Notoroni |  |
| The back | Notoli |  |
| The thigh | Nocazo |  |
| The nipples | Nocini |  |
| The foot | Nocizi | Nukii |
| The toes | Nocizirimi |  |
| The calf of the leg | Nocavas |  |
| A cracodile | Cazuiti | Amana |
| A fish | Cimasi | Timaki |
| Maize | Cana | Jomaki |
| Plantain | Paratana (Teot)§ | Arata |

*The words of the Maypare language have been taken from the works of Gili and Hervas. I collected the words placed between parentheses from a young Maco Indian, who understood the Maypure language.

+ I am ignorant of what ima signifies in this compound word. Eno means in Maypure the sky and thunder. Ina signifies mother.
$\ddagger$ The syllables no and $n \approx$, joined to the words that designate parts of the body, might have been suppressed; they answer to the possessive pronoun my.
§ We may be surprised to find the word teot denote the eminently nutritive substance that supplies the place of corn (the gift of a beneficent divinity), and on which the subsistence of man within the tropica

|  | pareni tonget. | maypuri tongue. |
| :---: | :---: | :---: |
| Cacao | Cacarua* |  |
| Tobacco | Jema | Jema |
| Pimento | (Pumake) |  |
| Mimosa inga | (Caraba) |  |
| Cecropia peltata | (Jocovi) |  |
| Agaric | (Cajuli) |  |
| " | Puziana (Pagiana) | Papeta (Popetas) |
| " | Sinapa (Achinafe) | Avanume (Avanome) |
| ", | Meteuba (Meuteufafa) | Apekiva Pejiiveji) |
| ", | Puriana vacavi | (Jaliva |
| " | Puriana vacavi uschanit |  |
| " | Puriassima vacavi | (Javiji) |

This comparison seems to prove that the analogies observed in the roots of the Pareni and the Maypure tongues are not to be neglected; they are, however, scarcely more frequent than those that have been observed between the Maypure of the Upper Orinoco and the language of the Moxos, which is spoken on the banks of the Marmora, from $15^{\circ}$ to $20^{\circ}$ of south latitude. The Parenis have in their pronunciation the English th, or tsa of the Arabians, as I clearly heard in the word Amethami (devil, evil spirit). I need not again notice the origin of the word camosi. Solitary resemblances of sounds are as little proof of communication between nations as the dissimilitude of a few roots furnishes evidence against the affiliation of the German from the Persian and the Greek. It is remarkable, however, that the names of the sun and moon are sometimes found to be identical in languages, the grammatical con-
depends. I may here mention. that the word Teo, or Teot, which in Aztec signifies God (Teotl, properly Teo, for $t l$ is only a termination), is found in the language of the Betoil of the Rio Meta. The name of the moon, in this language so remarkable for the complication of its grammatical structure, is Teo-ro. The name of the sun is Teo-umasoi. The particle ro designates a woman, umasoi a man. Among the Betoi, the Maypures, and so many other nations of both continents, the moon is believed to be the wife of the sun. But what is this root Teo? It appears to me very doubtful, that Teo-ro should signify God-woman, for Memelw is the name of the All-powerful Being in the Betol langnage.
-Has this word been introduced from a communication with Europeans? It is almost identical with the Mexican (Aztec) word cacava.
struction of which is entirely different; I may cite as examples the Guarany and the Omagua,* languages of nations formerly very powerful. It may be conceived that, with the worship of the stars and of the powers of nature, words which have a relation to these objects might pass from one idiom to another. I showed the constellation of the Southern Cross to a Pareni Indian, who covered the lantern while I was taking the circum-meridian heights of the stars; and he called it Bahumehi, a name which the caribe fish, or serra salme, also bears in Pareni. He was ignorant of the name of the belt of Orion; but a Poignave Indian, $\dagger$ who knew the constellations better, assured me that in his tongue the belt of Orion bore the name of Fuebot; he called the moon Zenquerot. These two words have a very peculiar character for words of American origin. As the names of the constellations may have been transmitted to immense distances from one nation to another, these Poignave words have fixed the attention of the learned, who have imagined they recognize the Phomician and Moabite tongues in the word camosi of the Pareni. Fuebot and zenquerot seem to remind us of the Phœenician words mot (clay), ardod (oak-tree), ephod, \&c. But what can we conclude from simple terminations which are most frequently foreign to the roots? In Hebrew the feminine plurals terminate also in oth. I noted entire phrases in Poignave; but the young man whom I interrogated spoke so quick that I could not seize the division of the words, and should have mixed them confusedly together had I attempted to write them down. $\ddagger$

* Sun and Moon, in Guarany, Quarasi and Jasi ; in Omagua, Huarassi and Jase. I shall give, farther on, these same words in the principal languages of the old and new worlds. (See note at pp. 326-328.)
$\dagger$ At the Orinoco the Puignaves, or Poignaves, are distinguished from the Guipunaves (Dipunavi). The latter, on account of their language, are considered as belonging to the Maypure and Cabre nations; yet water is called in Poignave, as well as in Maypure, oueni.
$\ddagger$ For a curious example of this, see the speech of Artabanes in Aristophanes, (Acharn. act 1, scene 3,) where a Greek has attempted to give a Persian oration. See also Gibbon's Roman Empire, chap. liii, note 54, for a curious example of the way in which foreign languages have been disfigured when it has been attempted to represent them in a totally different tongue.

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The Mission near the raudal of Maypures was very considerable in the time of the Jesuits, when it reckoned six hundred inhabitants, among whom were several families of whites. Under the government of the Fathers of the Observance the population was reduced to less than sixty. It must be observed that in this part of South America cultivation has been diminishing for half a century, while beyond the forests, in the provinces near the sea, we find villages that contain from two or three thousand Indians. The inhabitants of Maypures are a mild, temperate people, and distinguished by great cleanliness. The savages of the Orinoco for the most part have not that inordinate fondness for strong liquors which prevails in North America. It is true that the Ottomacs, the Jaruros, the Achaguas, and the Caribs, are often intoxicated by the immoderate use of chiza and many other fermented liquors, which they know how to prepare with cassava, maize, and the saccharine fruit of the palm-tree; but travellers have as usual generalized what belongs only to the manners of some tribes. We were frequently unable to prevail upon the Guahibos, or the Maco-Piroas, to taste brandy while they were labouring for us, and seemed exhausted by fatigue. It will require a longer residence of Europeans in these countries to spread there the vices that are already common among the Indians on the coast. In the huts of the natives of Maypures we found an appearance of order and neatness, rarely met with in the houses of the missionaries.

These natives cultivate plantains and cavassa, but no maize. Cassava, made into thin cakes, is the bread of the country. Like the greater part of the Indians of the Orinoco, the inhabitants of Maypures have beverages which may be considered nourishing ; one of these, much celebrated in that country, is furnished by a palm-tree which grows wild in the vicinity of the mission on the banks of the Auvana. This tree is the seje: I estimated the number of flowers on one cluster at forty-four thousand; and that of the fruit, of which the greater part fall without ripening, at eight thousand. The fruit is a small fleshy drupe. It is immersed for a few minutes in boiling water, to separate the kernel from the parenchymatous part of the sarcocarp, which has a sweet taste, and is pounded and bruised in a
large vessel rillen with water. The infusion yields a yellow18 l liquor, which tastes like milk of almonds. Sometimes papelon (unrefined sugar) is added. The missionary told us that the natives become visibly fatter during the two or three months in which they drink this seje, into which they dip their cakes of cassava. The piaches, or Indian jugglers, go into the forests, and sound the botuto (the sacred trumpet) under the seje palm-trees, "to force the tree," they say, "to yield an ample produce the following year." The people pay for this operation, as the Mongols, the Arabs, and nations still nearer to us, pay the chamans, the marabouts, and other classes of priests, to drive away the white ants and the locusts by mystic words or prayers, or to procure a cessation of continued rain, and invert the order of the seasons.
"I have a manufacture of pottery in my village," said Father Zea, when accompanying us on a visit to an Indian family, who were occupied in baking, by a fire of brushwood, in the open air, large earthen vessels, two feet and a half high. This branch of manufacture is peculiar to the various tribes of the great family of Maypures, and they appear to have followed it from time immemorial. In every part of the forests, far from any human habitation, on digging the earth, fragments of pottery and delf are found. The taste for this kind of manufacture seems to have been common heretofore to the natives of both North and South America. To the north of Mexico, on the banks of the Rio Gila, among the ruins of an Aztec city; in the United States, near the tumuli of the Miamis ; in Florida, and in every place where any traces of ancient civilization are found, the soil covers fragments of painted pottery; and the extreme resemblance of the ornaments they display is striking. Savage nations, and those civilized people* who are condemned by their political and religious institutions always to imitate themselves, strive, as if by instinct, to perpetuate the same forms, to preserve a peculiar type or style, and to follow the methods and processes which were employed by their ancestors. In North America, fragments of delf ware have been

- The Hindoos, the Tibetians, the Chinese, the ancient Egyptians, the Aztecs, the Peruvians ; with whom the tendency toward civilization in a body has prevented the free development of the faculties of individuals.
discorered in places where there exist lines of fortification, and the walls of towns constructed by some unknown nation, now entirely extinct. The paintings on these fragments have a great similitude to those which are executed in our days on earthenware by the natives of Louisiana and Florida. Thus too, the Indians of Maypures often painted before our eyes the same ornaments as those we had observed in the cavern of Ataruipe, on the vases containing human bones. They were grecques, meanders, and figures of crocodiles, of monkeys, and of a large quadruped which I could not recognize, though it had always the same squat form. I might hazard the hypothesis that it belongs to another country, aud that the type had been brought thither in the great migration of the American nations from the north-west to the south and south-east; but I am rather inclinea to believe that the figure is intended to represent a tapir, and that the deformed image of a native animal has become by degrees one of the types that has been preserved.

The Maypures execute with the greatest skill grecques, or ornaments formed by straight lines variously combined, similar to those that we find on the vases of Magna Grecia, on the Mexican edifices at Mitla, and in the works of so many nations who, without communication with each other, find alike a sensible pleasure in the symmetric repetition of the same forms. Arabesques, meanders, and grecques, please our eyes, because the elements of which their series is composed, follow in rhythmic order. The eye finds in this order, in the periodical return of the same forms, what the ear distinguishes in the cadenced succession of sounds and concords. Can we then admit a doubt that the feeling of rhythm manifests itself in man at the first dawn of civilization, and in the rudest essays of poetry and song?

Among the natives of Maypures, the making of pottery is an occupation principally confined to the women. They purify the clay by repeated washings, form it into cylinders, and mould the largest vases with their hands. The American Indian is unacquainted with the potter's wheel, which was familiar to the nations of the east in the remotest antiquity. We may be surprised that the missionaries have not introduced this simple and useful machine among the natives of the Orinoco, yet we must recollect that three centuries
have not sufficed to make it known among the Indians of the peninsula of Araya, opposite the port of Cumana. The colours used by the Maypures are the oxides of iron and manganese, and particularly the yellow and red ochres that are found in the hollows of sandstone. Sometimes the fecula of the Bignonia chica is employed, after the pottery has been exposed to a feeble fire. This painting is covered with a varnish of algarobo, which is the transparent resin of the Hymenæa courbaril. The large vessels in which the chiza is preserved are called ciamacu; the smallest bear the name of mucra, from which word the Spaniards of the coast have framed murcura. Not only the Maypures, but also the Guaypunaves, the Caribs, the Ottomacs, and even the Guamos, are distinguished at the Orinoco as makers of painted pottery, and this manufacture extended formerly towards the banks of the Amazon. Orellana was struck with the painted ornaments on the ware of the Omaguas, who in his time were a populous commercial nation.

The following facts throw some light on the history of American civilization. In the United States, west of the Alleghany mountains, particularly between the Ohio and the great lakes of Canada, on digging the earth, fragments of painted pottery, mingled with brass tools, are constantly found. This mixture may well surprise us in a country where, on the first arrival of Europeans, the natives were ignorant of the use of metals. In the forests of South America, which extend from the equator as far as the eighth degree of north latitude, from the foot of the Andes to the Atlantic, this painted pottery is discovered in the most desert places, but it is found accompanied by hatchets of jade and other hard stones, skilfully. perforated. No metallic tools or ornaments have ever been discovered; though in the mountains on the shore, and at the back of the Cordilleras, the art of melting gold and copper, and of mixing the latter metal with tin to make cutting instruments, was known. How can we account for these contrasts between the temperate and the torrid zone? The Incas of Peru had pushed their conquests and their religious wars as far as the banks of the Napo and the Amazon, where their language extended over a small space of land; but the civilization of the Peruvians, of the inhabitants of Quito, and of the

Muyscas of New Grenada, never appears to have had any sensible influence on the moral state of the nations of Guiana. It must be observed further, that in North America, between the Ohio, Miami, and the Lakes, an unknown people, whom systematic authors would make the descendants of the Toltecs and Aztecs, constructed walls of earth and sometimes of stone without mortar,* from ten to fifteen feet high, and seven or eight thousand feet long. These singular circumvallations sometimes enclosed a hundred and fifty acres of ground. In the plains of the Orinoco, as in those of Marietta, the Miami, and the Ohio, the centre of an ancient civilization is found in the west on the back of the mountains; but the Orinoco, and the countries lying between that great river and the Amazon, appear never to have been inhabited by nations whose constructions have resisted the ravages of time. Though symbolical figures are found engraved on the hardest rocks, yet further south than eight degrees of latitude, no tumulus, no circumvallation, no dike of earth similar to those that exist farther north in the plains of Varinas and Canagua, has been found. Such is the contrast that may be observed between the eastern parts of North and South America, those parts which extend from the table-land of Cundinamarcat and the mountains of Cayenne towards the Atlantic, and those which stretch from the Andes of New Spain towards the Alleghanies. Nations advanced in civilization, of which we discover traces on the banks of lake Teguyo and in the Casas grandes of the Rio Gila, might have sent some tribes eastward into the open countries of the Missouri and the Ohio, where the climate differs little from that of New Mexico; but in South America, where the great flux of nations has continued from north to south, those who had long enjoyed the mild temperature of the back of the equinoctial Cordilleras no doubt dreaded a descent into burning plains bristled with forests, and inundated by the periodical swellings of rivers. It is easy to conceive how much the force of vegetation, and the nature of the soil and

[^279]climate, within the torrid zone, embarrassed the natives in regard to migration in numerous bodies, prevented settlements requiring an extensive space, and perpetuated the misery and barbarism of solitary hordes.

The feeble civilization introduced in our days by the Spanish monks pursues a retrograde course. Father Gili relates that, at the time of the expedition to the boundaries, agriculture began to make some progress on the banks of the Orinoco; and that cattle, especially goats, had multiplied considerably at Maypures. We found no goats, either in the mission or in any other village of the Orinoco; they had all been devoured by the tigers. The black and white breeds of pigs only, the latter of which are called French pigs (puercos franceses), because they are believed to have come from the Caribbee Islands, have resisted the pursuit of wild beasts. We saw with much pleasure guacamayas, or tame macaws, raund the huts of the Indians, and flying to the fields like our pigeons. This bird is the largest and most majestic species of parrot with naked cheeks that we found in our travels. It is called in Marativitan, cahuei. Including the tail, it is two feet three inches long. We had observed it also on the banks of the Atabapo, the Temi, and the Rio Negro. The flesh of the cahuei, which is frequently eaten, is black and somewhat tough. These macaws, whose plumage glows with vivid tints of purple, blue, and yellow, are a great ornament to the Indian farm-yards; they do not yield in beauty to the peacock, the golden pheasant, the pauxi, or the alector. The practice of rearing parrots, birds of a family so different from the gallinaceous tribes, was remarked by Columbus. When he discovered America he saw macaws, or large parrots, which served as food to the natives of the Caribbee Islands, instead of fowls.

A majestic tree, more than sixty feet high, which the planters call fruta de burro, grows in the vicinity of the fittle village of Maypures. It is a new species of the unona, and has the stateliness of the Uvaria zeylanica of Aublet. Its branches are straight, and rise in a pyramid, nearly like the poplar of the Mississippi, erroneously called - the Lombardy poplar. The tree is celebrated for its aromatic fruit, the infusion of which is a powerful febrifuge.

The poor missionaries of the Orinoco, who are afflicted with tertian fevers during a great part of the year, seldom travel without a little bag filled with frutas de burro. I have already observed, that between the tropics, the use of aromatics, for instance very strong coffee, the Croton cascarilla, or the pericarp of the Unona xylopioildes, is generally preferred to that of the astringent bark of cinchona, or of Bonplandia trifolatia, which is the Angostura bark. The people of America have the most inveterate prejudice against the employment of different kinds of cinchona; and in the very countries where this valuable remedy grows, they try (to use their own phrase) to cut off the fever, by infusions of Scoparia dulcis, and hot lemonade prepared with sugar and the small wild lime, the rind of which is equally oily and aromatic.

The weather was unfavourable for astronomical observations. I obtained, however, on the 20th of April, a good series of corresponding altitudes of the sun, according to which the chronometer gave $70^{\circ} 37^{\prime} 33^{\prime \prime}$ for the longitude of the mission of Maypures; the latitude was found, by a star ôbserved towards the north, to be $5^{\circ} 13^{\prime} 57^{\prime \prime}$; and by a stär ${ }^{\text {º }}$ observed towards the south, $5^{\circ} 13^{\prime} 7^{\prime \prime}$. The error of the most recent maps is half a degree of longitude and half a degree of latitude. It would be difficult to relate the trouble and torments which these nocturnal observations cost us. Nowhere is a denser cloud of mosquitos to be found. It formed, as it were, a particular stratum some feet above the ground, and it thickened as we brought lights to illumine our artificial horizon. The inhabitants of Maypures, for the most part, quit the village to sleep in the islets amid the cataracts, where the number of insects is less; others make a fire of brushwood in their huts, and suspend their hammocks in the midst of the smoke.

We spent two days and a half in the little village of Maypures, on the banks of the great Upper Cataract, and on the 21 st April we embarked in the canoe we had obtained from the missionary of Carichana. It was much damaged by the shoals it had struck against, and the carelessness of the Indians; but still greater dangers awaited it. It was to be dragged over land, across an isthmus of thirty-six thousand feet; from the Rio Tuamini to the

Rio Negro, to go up by the Cassiquiare to the Orinoco, and to repass the two raudales.

When the traveller has passed the Great Cataracts, he feels as if he were in a new world, and had overstepped the barriers which nature seems to have raised between the civilized countries of the coast and the savage and unknown interior. Towards the east, in the bluish distance, we saw for the last time the high chain of the Cunavami mountains. Its long, horizontal ridge reminded us of the Mesa of the Brigantine, near Cumana; but it terminates by a truncated summit. The Peak of Calitamini (the name given to this summit) glows at sunset as with a reddish fire. This appearance is every day the same. No one ever approached this mountain, the height of which does not exceed six hundred toises. I believe this splendour, commonly reddish but sometimes silvery, to be a reflection produced by large plates of talc, or by gneiss passing into mica-slate. The whole of this country contains granitic rocks, on which here and there, in little plains, an argillaceous grit-stone immediately reposes, containing fragments of quartz and of brown iron-ore.

In going to the embarcadero, we caught on the trunk of a hevea* a new species of tree-frog, remarkable for its beautiful colours; it had a yellow belly, the back and head of a fine velvety purple, and a very narrow stripe of white from the point of the nose to the hinder extremities. This frog was two inches long, and allied to the Rana tinctoria, the blood of which, it is asserted, introduced into theoskin of a parrot, in places where the feathers have been plucked out, occasions the growth of frizzled feathers of a yellow or red colour. The Indians showed us on the way, what is no doubt very curious in that country, traces of cartwheels in the rock. They spoke, as of an unknown animal, of those beasts with large horns, which, at the time of the expedition to the boundaries, drew the boats through the valley of Keri, from the Rio Toparo to the Rio Cameji, to avoid the cataracts, and save the trouble of unloading the merchandize. I believe these poor inhabitants of Maypures would now be as much astonished at the sight of an ox of the Spanish breed, as the Romans were at the sight of - One of those trees whose milk yields caoutchouc.
the 'Lucanian oxen,' as they called the elephants of the army of Pyrrhus.

We embarked at Puerto de Arriba, and passed the Raudal de Cameji with some difficulty. This passage is reputed to be dangerous when the water is very high; but we found the surface of the river beyond the raudal as smooth as glass. We passed the night in a rocky island called Piedra Raton, which is three-quarters of a league long, and displays that singular aspect of rising vegetation, those clusters of shrubs, scattered over a bare and rocky soil, of which we have often spoken.

On the 22nd of April we departed an hour and a half before sunrise. The morning was humid but delicious; not a breath of wind was felt; for south of Atures and Maypures a perpetual calm prevails. On the banks of the Rio Negro and the Cassiquiare, at the foot of Cerro Duida, and at the mission of Santa Barbara, we never heard that rustling of the leaves which has such a peculiar charm in very hot climates. The windings of rivers, the shelter of mountains, the thickness of the forests, and the almost continual rains, at one or two degrees of latitude north of the equator, contribute no doubt to this phenomenon, which is peculiar to the missions of the Orinoco.

In that part of the valley of the Amazon which is south of the equator, but at the same distance from it, as the places just mentioned, a strong wind always rises two hours after mid-day. This wind blows constantly against the stream, and is felt only in the bed of the river. Below San Borja it is an easterly wind; at Tomependa I found it between north and north-north-east; it is still the same breeze, the wind of the rotation of the globe, but modified by slight local circumstances. By favour of this general breeze you may go up the Amazon under sail, from Grand Para as far as Tefe, a distance of seven hundred and fifty leagues. In the province of Jaen de Bracamoros, at the foot of the western declivity of the Cordilleras, this Atlantic breeze rises sometimes to a tempest.
It is highly probable that the great salubrity of the Amazon is owing to this constant breeze. In the stagnant air of the Upper Orinoco the chemical affinities act more powerfully, and more deleterious miasmata are formed.

The insalubrity of the climate would be the same on the woody banks of the Amazon, if that river, running like the Niger from west to east, did not follow in its immense length the same direction, which is that of the trade-winds. The valley of the Amazon is closed only at its western extremity, where it approaches the Cordilleras of the Andes. Towards the east, where the sea-breeze strikes the New Continent, the shore is raised but a few feet above the level of the Atlantic. The Upper Orinoco first runs from east to west, and then from north to south. Where its course is nearly parallel to that of the Amazon, a very hilly country (the group of the mountains of Parima and of Dutch and French Guiana) separates it from the Atlantic, and prevents the wind of rotation from reaching Esmeralda. This wind begins to be powerfully felt only from the confluence of the Apure, where the Lower Orinoco runs from west to east in a vast plain open towards the Atlantic, and therefore the climate of this part of the river is less noxious than that of the Upper Orinoco.

In order to add a third point of comparison, I may mention the valley of the Rio Magdalena, which, like the Amazon, has one direction only, but unfortunately, instead of being that of the breeze, it is from south to north. Situated in the region of the trade-winds, the Rio Magdalena has the stagnant air of the Upper Orinoco. From the canal of Mahates as far as Honda, particularly south of the town of Mompox, we never felt the wind blow but at the approach of the evening storms. When, on the contrary, you proceed up the river beyond Honda, you find the atmosphere often agitated. The strong winds that are ingulfed in the valley of Neiva are noted for their excessive heat. We may be at first surprised to perceive that the calm ceases as we approach the lofty mountains in the upper course of the river, but this astonishment ends when we recollect that the dry and burning winds of the Llanos de Neiva are the effect of descending currents. The columns of cold air rush from the top of the Nevados of Quindiu and of Guanacas into the valley, driving before them the lower strata of the atmosphere. Everywhere the unequal heating of the soil, and the proximity of mountains covered with perpetual snow, cause partial currents within
the tropics, as well as in the temperate zone. The violent winds of Neiva are not the effect of a repercussion of the trade-winds; they rise where those winds cannot penetrate; and if the mountains of the Upper Orinoco, the tops of which are generally crowned with trees, were more elevated, they would produce the same impetuous movements in the atmosphere as we observe in the Cordilleras of Peru, of Abyssinia, and of Thibet. The intimate connection that exists between the direction of rivers, the height and disposition of the adjacent mountains, the movements of the atmosphere, and the salubrity of the climate, are subjects well worthy of attention. The study of the surface and the inequalities of the soil would indeed be irksome and useless were it not connected with more general considerations.

At the distance of six miles from the island of Piedra Raton we passed, first, on the east, the mouth of the Rio Sipapo, called Tipapu by the Indians; and then, on the west, the mouth of the Rio Vichada. Near the latter are some rocks covered by the water, that form a small cascade or raudalito. The Rio Sipapo, which Father Gili went up in 1757, and which he says is twice as broad as the Tiber, comes from a considerable chain of mountains, which in its southern part bears the name of the river, and joins the group of Calitamini and of Cunavami. Next to the Peak of Duida, which rises above the mission of Esmeralda, the Cerros of Sipapo appeared to me the most lofty of the whole Cordillera of Parima. They form an immense wall of rocks, shooting up abruptly from the plain, its craggy ridge of running from S.S.E. to N.N.W. I believe these crags, these indentations, which equally occur in the sandstone of Montserrat in Catalonia,* are owing to blocks of granite heaped together. The Cerros de Sipapo wear a different aspect every hour of the day. At sunrise the thick vegetation with which these mountains are clothed is tinged with that dark green inclining to brown, which is peculiar to a region where trees with coriaceous leaves prevail. Broad and strong shadows are projected on the neighbouring plain, and form a contrast with the vivid light

[^280]diffused over the ground, in the air, and on the surface of the waters. But towards noon, when the sun reaches its zenith, these strong shadows gradually disappear, and the whole group is veiled by an aërial vapour of a much deeper azure than that of the lower regions of the celestial vault. These vapours, circulating around the rocky ridge, soften its outline, temper the effects of the light, and give the landscape that aspect of calmness and repose which in nature, as in the works of Claude Lorraine and Poussin, arises from the harmony of forms and colours.

Cruzero, the powerful chief of the Guaypunaves, long resided behind the mountains of Sipapo, after having quitted with his warlike horde the plains between the Rio Inirida and the Chamochiquini. The Indians told us that the forests which cover the Sipapo abound in the climbing plant called vehuco de maimure. This species of liana is celebrated among the Indians, and serves for making baskets and weaving mats. The forests of Sipapo arb altogether unknown, and there the missionaries place the nation of the Rayas," whose mouths are believed to be in their navels. An old Indian, whom we met at Carichana, and who boasted of having often eaten human flesh, had seen these acephali "with his own eyes." These absurd fables are spread as far as the Llanos, where you are not always permitted to doubt the existence of the Raya Indians. In every zone intolerance accompanies credulity; and it might be said that the fictions of ancient geographers had passed from one hemisphere to the other, did we not know that the most fantastic productions of the imagination, like the works of nature, furnish everywhere a-certain analogy of aspect and of form.

We landed at the mouth of the Rio Vichada or Visata to examine the plants of that part of the country. The scenery is very singular. The forest is thin, and an innumerable quantity

[^281]of small rocks rise from the plain. These form massy prisms, ruined pillars, and solitary towers fifteen or twenty feet high. Some 'are shaded by the trees of the forest, others have their summits crowned with palms. These rocks are of granite passing into gneiss. At the confluence of the Vichada the rocks of granite, and what is still more remarkable, the soil itself, are covered with moss and lichens. These latter resemble the Cladonia pyxidata and the Lichen rangiferinus, so common in the north of Europe. We could scarcely persuade ourselves that we were elevated less than one hundred toises above the level of the sea, in the fifth degree of latitude, in the centre of the torrid zone, which has so long been thought to be destitute of cryptogamous plants. The mean temperature of this shady and humid spot probably exceeds twenty-six degrees of the centigrade thermometer. Reflecting on the small quantity of rain which had hitherto fallen, we were surprised at the beautiful verdure of the forests. This peculiarity characterises the valley of the Upper Orinoco; on the coast of Caracas, and in the Llanos, the trees in winter (in the season called summer in South America, north of the equator) are stripped of their leaves, and the ground is covered only with yellow and withered grass. Between the solitary rocks just described arise some high plants of columnar cactus (Cactus septemangularis), a very rare appearance south of the cataracts of Atures and Maypures.

Amid this picturesque scene M. Bonpland was fortunate enough to find several specimens of Laurus cinnamomoïdes, a very aromatic species of cinnamon, known at the Orinoco by the names of varimach and of canelilla.* This valuable production is found also in the valley of the Rio Caura, as well as, near Esmeralda, and eastward of the Great Cataracts. The Jesuit Francisco de Olmo appears to have been the first who discovered the canelilla, which he did in the country of the Piaroas, near the sources of the Cataniapo. The missionary Gili, who did not advance so far as the regions I am now describing, seems to confound the varimacu, or guarimacu, with the myristica, or nutmeg-tree of America. These barks and aromatic fruits, the cinnamon, the nutmeg, the Myrtus pimenta, and the Laurus pucheri,

[^282]would have become important objects of trade, if Europe, at the period of the discovery of the New World, had not already been accustomed to the spices and aromatics of India. The cinnamon of the Orinoco, and that of the Andaquies missions, are, however, less aromatic than the cinnamon of Ceylon, and would still be so even if dried and prepared by similar processes.

Every hemisphere produces plants of a different species; and it is not by the diversity of climates that we can attempt to explain why equinoctial Africa has no laurels, and the New World no heaths; why calceolarim are found wild only in the southern hemisphere; why the birds of the East Indies glow with colours less splendid than those of the hot parts of America; finally, why the tiger is peculiar to Asia, and the ornithorynchus to Australia. In the vegetable as well as in the animal kingdom, the causes of the distribution of the species are among the mysteries which natural philosophy cannot solve. The attempts made to explain the distribution of various species on the globe by the sole influence of climate, take their date from a period when physical geography was still in its infancy; when, recurring incessantly to pretended contrasts between the two worlds, it was imagined that the whole of Africa and of America resembled the deserts of Egypt and the marshes of Cayenne. At present, when men judge of the state of things not from one type arbitrarily chosen, but from positive knowledge, it is ascertained that the two continents, in their immense extent, contain countries that are altogether analagous. There are regions of America as barren and burning as the interior of Africa. Those islands which produce the spices of India are scarcely remarkable for their dryness; and it is not on account of the humidity of the climate, as has been affirmed in recent works, that the New Continent is deprived of those fine species of laurinim and myristicæ, which are found united in one little corner of the earth in the archipelago of India. For some years past cinnamon has been cultivated with success in several parts of the New Continent; and a zone that produces the coumarouna, the vanilla, the pucheri, the pine-apple, the pimento, the balsam of tolu, the Myroxylon peruvianum, the croton, the citroma, the pejoa, the incienso
of the Silla of Caracas, the quereme, the pancratium, and so many majestic liliaceous plants, cannot be considered as destitute of aromatics. Besides, a dry air favours the development of the aromatic or exciting properties, only in certain species of plants. The most inveterate poisons are produced in the most humid zone of America; and it is precisely under the influence of the long rains of the tropics, that the American pimento, (Capsicum baccatum), the fruit of which is of often as caustic and fiery as Indian pepper, vegetates best. From all these considerations it follows, 1st, that the New Continent possesses spices, aromatics, and very active vegetable poisons, peculiar to itself, and differing specifically from those of the Old World; 2ndly, that the primitive distribution of species in the torrid zone cannot be explained by the influence of climate solely, or by the distribution of temperature, which we observe in the present state of our planet; but that this difference of climates leads us to perceive why a given type of organization developes itself more vigorously in such or such local circumstances. We can conceive that a small number of the families of plants, for instance the musacem and the palms, cannot belong to very cold regions, on account of their internal structure, and the importance of certain organs; but we cannot explain why no one of the family of the Melastomacem vegetates north of the parallel of the thirtieth degree of latitude, or why no rose-tree belongs to the southern hemisphere. Analogy of climates is often found in the two continents, without identity of productions.

The Rio Vichada, which has a small raudal at its confluence with the Orinoco, appeared to me, next to the Meta and the Guaviare, to be the most considerable river coming from the west. During the last forty years no European has navigated the Vichada. I could learn nothing of its sources ; they rise, I believe, with those of the Tomo, in the plains that extend to the south of Casimena. Fugitive Indians of Santa Rosalia de Cabapuna, a village situate on the banks of the Meta, have arrived even recently, by the Rio Vichada, at the cataract of Maypures; which sufficiently proves that the sources of this river are not very distant from the Meta. Father Gumilla has preserved the names
of several German and Spanish Jesuits, who in 1734 fell victims to their zeal for religion, by the hands of the Caribs, on the now desert banks of the Vichada.
Having passed the Caño Pirajavi on the east, and then a small river on the west, which issues, as the Indians say, from a lake called Nao, we rested for the night on the shore of the Orinoco, at the mouth of the Zama, a very considerable river, but as little known as the Vichada. Notwithstanding the 'black waters' of the Zama, we suffered greatly from insects. The night was beautiful, without a breath of wind in the lower regions of the atmosphere, but towards two in the morning we saw thick clouds crossing the zenith rapidly from east to west. When, declining toward the horizon, they traversed the great nebulæ of Sagittarius and the Ship, they appeared of a dark blue. The light of the nebulm is never more splendid than when they are in part covered by sweeping clouds. We observe the same phenomenon in Europe in the Milky Way, in the aurora borealis when it beams with a silvery light; and at the rising and setting of the sun in that part of the sky that is whitened* from causes which philosophers have not yet sufficiently explained.

The vast tract of country lying between the Meta, the Vichada, and the Guaviare, is altogether unknown a league from the banks; but it is believed to be inhabited by wild Indians of the tribe of Chiricoas, who fortunately build no boats. Formerly, when the Caribs, and their enemies the Cabres, traversed these regions with their little fleets of rafts and canoes, it would have been imprudent to have passed the night near the mouth of a river running from the west. The little settlements of the Europeans having now caused the independent Indians to retire from the banks of the Upper Orinoco, the solitude of these regions is such, that from Carichana to Javita, and from Esmeralda to San Fernando de Atabapo, during a course of one hundred and eighty leagues, we did not meet a single boat.

At the mouth of the Rio Zama we approach a class of rivers, that merits great attention. The Zama, the Mataveni, the Atabapo, the Tuamini, the Temi, and the Guainia, are aguas negras, that is, their waters, seen in a large body,

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appear brown like coffee, or of a greenish black. These waters, notwithstanding, are most beautiful, clear, and agreeable to the taste. I have observed above, that the crocodiles, and, if not the zancudos, at least the mosquitos, generally shun the black waters. The people assert too, that these waters do not colour the rocks; and that the white rivers have black borders, while the black rivers have white. In fact, the shores of the Guainia, known to Europeans by the name of the Rio Negro, frequently exhibit masses of quartz issuing from granite, and of a dazzling whiteness. The waters of the Mataveni, when examined in a glass, are pretty white; those of the Atabapo retain a slight tinge of yellowish-brown. When the least breath of wind agitates the surface of these 'black rivers' they appear of a fine grass-green, like the lakes of Switzerland. In the shade, the Zama, the Atabapo, and the Guainia, are as dark as coffee-grounds. These phenomena are so striking, that the Indians everywhere distinguish the waters by the terms black and white. The former have often served me for an artificial horizon; they reflect the image of the stars with admirable clearness.

The colour of the waters of springs, rivers, and lakes, ranks among those physical problems which it is difficult, if not impossible, to solve by direct experiments. The tints of reflected light are generally very different from the tints of transmitted light; particularly when the transmission takes place through a great portion of fluid. If there were no absorption of rays, the transmitted light would be of a colour corresponding with that of the reflected light; and in general we judge imperfectly of transmitted light, by filling with water a shallow glass with a narrow aperture. In a river, the colour of the reflected light comes to us always from the interior strata of the fluid, and not from the upper stratum.

Some celebrated naturalists, who have examined the purest waters of the glaciers, and those which flow from mountains covered with perpetual snow, where the earth is destitute of the relics of vegetation, have thought that the proper colour of water might be blue, or green. Nothing, in fact, proves, that water is by nature white; and we must always admit the presence of a colouring principle, when water viewed by reflection is coloured. In the rivers that contain a colouring
principle, that principle is generally so little in quantity, that it eludes all chemical research. The tints of the ocean seem often to depend neither on the nature of the bottom, nor on the reflection of the sky on the clouds. Sir Humphrey Davy was of opinion that the tints of different seas may very likely be owing to different proportions of iodine.

On consulting the geographers of antiquity, we find that the Greeks had noticed the blue waters of Thermopylm, the red waters of Joppa, and the black waters of the hot-baths of Astyra, opposite Lesbos. Some rivers, the Rhone for instance, near Geneva, have a decidedly blue colour. It is said, that the snow-waters of the Alps are sometimes of a dark emerald green. Several lakes of Savoy and of Peru have a brown colour approaching black. Most of these phenomena of coloration are observed in waters that are believed to be the purest; and it is rather from reasonings founded on analogy, than from any direct analysis, that we may throw any light on so uncertain a matter. In the vast system of rivers near the mouth of the Rio Zama, a fact which appears to me remarkable is, that the black waters are principally restricted to the equatorial regions. They begin about five degrees of north latitude; and abound thence to beyond the equator as far as about two degrees of south latitude. The mouth of the Rio Negro is indeed in the latitude of $3^{\circ} 9^{\prime}$; but in this interval the black and white waters are so singularly mingled in the forests and the savannahs, that we know not to what cause the coloration must be attributed. The waters of the Cassiquiare, which fall into the Rio Negro, are as white as those of the Orinoco, from which it issues. Of two tributary streams of the Cassiquiare very near each other, the Siapa and the Pacimony, one is white, the other black.

When the Indians are interrogated respecting the causes of these strange colorations, they answer, as questions in natural philosophy or physiology are sometimes answered in Europe, by repeating the fact in other terms. If you address yourself to the missionaries, they reply, as if they had the most convincing proofs of the fact, that " the waters are coloured by washing the roots of the sarsaparilla." The Smilacem no doubt abound on the banks of the Rio Negro, the Pacimony, aud the Cababury; their roots, macerated in
the water, yield an extractive matter, that is brown, bitter, and mucilaginous; but how many tufts of smilax have we seen in places, where the waters were entirely white. In the marshy forest which we traversed, to convey our canoe from the Rio Tuamini to the Caño Pimichin and the Rio Negro, why, in the same soil, did we ford alternately rivulets of black and white water? Why did we find no river white near its springs, and black in the lower part of its course? I know not whether the Rio Negro preserves its yellowish brown colour as far as its mouth, notwithstanding the great quantity of white water it receives from the Cassiquiare and the Rio Blanco.

Although, on account of the abundance of rain, vegetation is more vigorous close to the equator than eight or ten degrees north or south, it cannot be affirmed, that the rivers with black waters rise principally in the most shady and thickest forests. On the contrary, a great number of the aguas negras come from the open savannahs that extend from the Meta beyond the Guaviare towards the Caqueta. In a journey which I made with Señor Montufar from the port of Guayaquil to theBodegas de Babaojo, at the period of the great inuudations, I was struck by the analogy of colour displayed by the vast savannahs of the Invernadero del Garzal and of the Lagartero, as well as by the Rio Negro and the Atabapo. These savannahs, partly inundated during three months, are composed of paspalum, eriochloa, and several species of cyperacem. We sailed on waters that were from four to five feet deep; their temperature was by day from $33^{\circ} 34^{\circ}$ of the centigrade thermometer; they exhaled a strong smell of sulphuretted hydrogen, to which no doubt some rotten plants of arum and heliconia, that swam on the surface of the pools, contributed. The waters of the Lagartero were of a golden yellow by transmitted, and coffee-brown by reflected light. They are no doubt coloured by a carburet of hydrogen. An analogous phenomenon is observed in the dunghill-waters prepared by our gardeners, and in the waters that issue from bogs. May we not also admit, that it is a mixture of carbon and hydrogen, an extractive vegetable matter, that colours the black rivers, the A.tabapo, the Zama, the Mataveni, and the Guainia? The frequency of of the equatorial rains contributes no doubt to this colora-
tion by filtration through a thick mass of grasses. I suggest these ideas only in the form of a doubt. The colouring principle seems to be in little abundance; for I observed that the waters of the Guaina or Rio Negro, when subjected to ebullition, do not become brown like other fluids charged with carburets of hydrogen.

It is also very remarkable, that this phenomenon of black waters, which might be supposed to belong only to the low regions of the torrid zone, is found also, though rarely, on the table-lands of the Andes. The town of Cuenca in the kingdom of Quito, is surrounded by three small rivers, the Machangara, the Rio del Matadero, and the Yanuncai ; of which the two former are white, and the waters of the last are black (aguas negras). These waters, like those of the Atabapo, are of a coffee-colour by reflection, and pale yellow by transmission. They are very clear, and the inhabitants of Cuenca, who drink them in preference to any other, attribute their colour to the sarsaparilla, which it is said grows abundantly on the banks of the Rio Yanunçai.

We left the mouth of the Zama at five in the morning of the 23 rd of April. The river continued to be skirted on both sides by a thick forest. The mountains on the east seemed gradually to retire farther back. We passed first the mouth of the Rio Mataveni, and afterward an islet of a very singular form; a square granitic rock that rises in the middle of the water. It is called by the missionaries El Castillito, or the Little Castle. Black bands seem to indicate, that the highest swellings of the Orinoco do not riso at this place above eight feet; and that the great swellings observed lower down are owing to the tributary streams which flow into it north of the raudales of Atures and Maypures. We passed the night on the right bank opposite the mouth of the Rio Siucurivapu, near a rock called Aricagua. During the night an innumerable quantity of bats issued from the clefts of the rock, and hovered around our hammocks.

On the 24th a violent rain obliged us early to return to our boat. We departed at two o'clock, after having lost some books, which we could not find in the darkness of the night, on the rock of Aricagua. The river runs straight from south to north; its banks are low, and shaded on both sides
by thick forests. We passed the mouths of the Ucata, the Arapa, and the Caranaveni. About four in the afternoon we landed at the Conucos de Siquita, the Indian plantations of the mission of San Fernando. The good people wished to detain us among them, but we continued to go up against the current, which ran at the rate of five feet a second, according to a measurement I made by observing the time that a floating body took to go down a given distance. We entered the mouth of the Guaviare on a dark night, passed the point where the Rio Atabapo joins the Guaviare, and arrived at the mission after midnight. We were lodged as usual at the Convent, that is, in the house of the missionary, who, though much surprised at our unexpected visit, nevertheless received us with the kindest hospitality.

## NOTE.

Ir, in the philosophical study of the structure of languages, the analogy of a few roots acquires value only when they can be geographically connected together, neither is the want of resemblance in roots any very strong proof against the common origin of nations. In the different dialects of the Totonac language (that of one of the most ancient tribes of Mexico) the sun and the moon have names which custom has rendered entirely different. This difference is found among the Caribs between the language of men and women; a phenomenon that probably arises from the circumstance that, among prisoners, men were oftener put to death than women. Females introduced by degrees words of a foreign language into the Caribbee; and, as the girls followed the occupations of the women much more than the boys, a language was formed peculiar to the women. I shall record in this note the names of the sun and moon in a great number of American and Asiatic idioms, again reminding the reader of the uncertainty of all judgments founded merely on the comparison of solitary words.

IN THE NEW WORLD.

|  | Sun. | Moos. |
| :---: | :---: | :---: |
| Eastern Esquimaux <br> (Greenland) <br> Western Esquimaux <br> (Kadjak) | Ajut, kaumat, saka- <br> nach <br> Tachingugak, mad- <br> schalk | Anningat, kaumai, <br> tatcok <br> Igaluk, tangeik |


|  | Stix. | Moon. |
| :---: | :---: | :---: |
| Ojibbeway | Kissis | Debicot |
| Delaware | Natatane | Keyshocof |
| Nootka | Opulszthl | Omulsathl |
| Otomi | Hindi | Zana |
| Aztec or Mexican | Tonatiuh | Meztli |
| Cora | Taica | Maitsaca |
| Huasteca | Aquicha | Aytz |
| Muysca | Zuhè (sua) | Chia |
| Yaruro |  | Goppe |
| Caribbee and Tamanac | Velou (hueiou) | Nouno (nonum) |
| Maypure | Kie | Kejapi |
| Lule | Inni | Allit |
| Vilela | Olo | Copi |
| Moxo | Sachi | Cohe |
| Chiquito | Suus | Copi |
| Guarani | Quarasi | Jasi |
| Tupi (Brasil) | Coaracy | Iacy |
| Peruvian (Quichua) | Inti | Quilla |
| Araucan (Chili) | Antu | Cuyen. |

IN THE OLD WORLD.

|  | Sun. | Moon. |
| :---: | :---: | :---: |
| Mongol | Nara (naran) | Sara (saran) |
| Mantchou | Choun | Bia |
| Tschaghatai | Koun | Ag |
| Ossête (of Cancasus) | Khourr | Mai |
| Tibetan | Niyma | Rdjawa |
| Chinese | Jy | Yue |
| Japanese | Fi | Tsouki - |
| Sanscrit | Surya, aryama, mitra, aditya, arka, hamsa | Tschandra, tschandrama, soma, masi |
| Persian | Chor, chorschid, aftab | Mah |
| Zend | Houere |  |
| Pehlvi | Schemschia, zabzoba, kokma | Kokma |
| Phoeniclan | Schemesih |  |
| Hebrew | Schemesch | Yarea |
| Aramean or Chaldean | Schimscha | Yarha |
| Syrian | Schemscho | Yarho |
| Arabic | Schams | Kamar |
| Ethiopian | Tzabay | Warha |

The American words are written according to the Spanish orthography. I would not change the orthography of the Nootka word onulszth, taken from Cook's Voyages, to show how much Volney's idea of introducing an uniform notation of sounds is worthy of attention, if not upplied to the languages of the East written without vowels. In onulszth there are four signs for one single consonant. We have already seen that American nations, speaking languages of a very different structure, call the sun by the same name; that the moon is sometimes called sleeping sun, sun of night, light of night; and that sometimes the two orbs have the same denomination. These examples are taken from the Guarany, the Omagua, Shawanese, Miami, Maco, and Ojibbeway idioms. Thus in the Old World, the sun and moon are denoted in Arabic by niryn, 'the luminaries;' thus, in Persian, the most common words, afitab and chorschid, are compounds. By the migration of tribes from Asia to America, and from America to Asia, a certain number of roots have passed from one language into others; and these roots have been transported, like the fragments of a shipwreck, far from the coast, into the islands. (Sun, in New England, kone; in Tschagatai, koun; in Yakout, kouini. Star, in Huastec, ot; in Mongol, oddon; in Aztec, citlal, citl; in Persian, sitareh. House, in Aztec, calli; in Wogoul, kualla or kolla. Water, in Aztec, atel (itels, a river, in Vilela) ; in Mongol, Tscheremiss, and Tschouvass, atl, atelch, etel, or idel. Stone, in Caribbee, tebou; in the Lesgian of Caucssus, teb; in Aztec, tepetl; in Turkish, tepe. Food, in Quichua, micunnan; in Malay, macannon. Boat, in Haytian, canoa; in Ayno, cahani; in Greenlandish, kayak; in Turkish, kayik; in Samoyiede, kayouk; in the Germanic tongues, kahn.) But we must distinguish from these foreign elements what belongs fundamentally to the American idioms themselves. Such is the effect of time, and communication among nations, that the mixture with an heterogenons language has not only an influence upon roots, but most frequently ends by modifying and denaturalizing grammatical forms. "When a language resists a regular analysis," observes William von Humboldt, in his considerations on the Mexican, Cora, Totonac, and Tarahumar tongues, "we may suspect some mixture, some foreign influence; for the faculties of man, which are, as we may say, reflected in the structure of languages, and in their grammatical forms, act constantly in a regular and uniform manner."

## Chapter XXII.

San Fernando de Atabapo. - San Balthasar. -The rivers Temi and Tuamini.-Javita.-Portage from the Tuamini to the Rio Negro.

During the night, we had left, almost unperceived, the waters of the Orinoco; and at sumrise found ourselves as if transported to a new country, on the banks of a river the name of which we had scarcely ever heard pronounced, and which was to conduct us, by the portage of Pimichin, to the Rio Negro, on the frontiers of Brazil. "You will go up," said the president of the missions, who resides at San Fernando, "first the Atabapo, then the Temi, and finally, the Tuamini. When the force of the current of 'black waters' hinders you from advancing, you will be conducted out of the bed of the river through forests, which you will find inundated. Two monks only are settled in those desert places, between the Orinoco and the Rio Negro; but at Javita you will be furnished with the means of having your canoe drawn over land in the course of four days to Caño Pimichin. If it be not broken to pieces you will descend the Rio Negro without any obstacle (from north-west to south-east) as far as the little fort of San Carlos; you will go up the Cassiquiare (from south to north), and then return to San Fernando in a month, descending the Upper Orinoco from east to west." Such was the plan traced for our passage, and we carried it into effect without danger, though not without some suffering, in the space of thirtythree days. The Orinoco runs from its source, or at least from Esmeralda, as far as San Fernando de Atabapo, from east to west; from San Fernando, (where the junction of the Guaviare and the Atabapo takes place, as far as the mouth of the Rio Apure, it flows from south to north, forming the Great Cataracts; and from the mouth of the Apure as far as Angostura and the coast of the Atlantic its direction is from west to east. In the first part of its course, where the river flows from east to west, it forms that celebrated bifurcation so often disputed by geographers, of which I was the first enabled to determine the situation by
astronomical observations. One arm of the Orinoco, (the Cassiquiare, running from north to south, falls into the Guainia, or Rio Negro, which, in its turn, joins the Marañon, or river Amazon. The most natural way, therefore, to go from Angostura to Grand Para, would be to ascend the Orinoco as far as Esmeralda, and then to go down the Cassiquiare, the Rio Negro, and the Amazon; but, as the Rio Negro in the upper part of its course approaches very near the sources of some rivers that fall into the Orinoco near San Fernando de Atabapo (where the Orinoco abruptly changes its direction from east to west to take that from south to north), the passage up that part of the river between San Fernando and Esmeralda, in order to reach the Rio Negro, may be avoided. Leaving the Orinoco near the mission of San Fernando, the traveller proceeds up the little black rivers (the Atabapo, the Temi, and the Tuamini), and the boats are carried across an isthmus six thousand toises broad, to the banks of a stream (the Caño Pimichin) which flows into the Rio Negro. This was the course which we took.

The road from San Carlos to San Fernando de Atabapo is far more disagreeable, and is half as long again by the Cassiquiare as by Javita and the Caño Pimichin. In this region I determined, by means of a chronometer by Berthoud, and by the meridional heights of stars, the situation of San Balthasar de Atabapo, Javita, San Carlos del Rio Negro, the rock Culimacavi, and Esmeralda. When no roads exist save tortuous and intertwining rivers, when little villages are hidden amid thick forests, and when, in a country entirely flat, no mountain, no elevated object is visible from two points at once, it is only in the sky that we can read where we are upon the earth.

San Fernando de Atabapo stands near the confluence of three great rivers; the Orinoco, the Guaviare, and the Atabapo. Its situation is similar to that of Saint Louis or of New Madrid, at the junction of the Mississippi with the Missouri and the Ohio. In proportion as the activity of commerce increases in these countries traversed by immense rivers, the towns situated at their confluence will necessarily become bustling ports, depôts of merchandise, and centre points of civilization. Father Gumilla confesses, that in
his time no person had any knowledge of the course of the Orinoco above the mouth of the Guaviare.

D'Anville, in the first edition of his great map of South America, laid down the Rio Negro as an arm of the Orinoco, that branched off from the principal body of the river between the mouths of the Meta and the Vichada, near the cataract of Atures. That great geographer was entirely ignorant of the existence of the Cassiquiare and the Atabapo; and he makes the Orinoco or Rio Paragua, the Japura, and the Putumayo, take their rise from three branchings of the Caqueta. The expedition of the boundaries, commanded by Iturriaga and Solano, corrected these errors. Solano, who was the geographical engineer of this expedition, advanced in 1756 as far as the mouth of the Guaviare, after having passed the Great Cataracts. He found that, to continue to go up the Orinoco, he must direct his course towards the east ; and that the river received, at the point of its great inflection, in latitude $4^{\circ} 4^{\prime}$, the waters of the Guaviare, which two miles higher had received those of the Atabapo. Interested in approaching the Portuguese possessions as near as possible, Solano resolved to proceed onward to the south. At the confluence of the Atabapo and the Guaviare he found an Indian settlement of the warlike nation of the Guaypunaves. He gained their favour by presents, and with their aid founded the mission of San Fernando, to which he gave the appellation of villa, or town.

To make known the political importance of this Mission, we must recollect what was at that period the balance of power between the petty Indian tribes of Guiana. The banks of the Lower Orinoco had been long ensanguined by the obstinate struggle between two powerful nations, the Cabres and the Caribs. The latter, whose principal abode since the close of the seventeenth century has been between the sources of the Carony, the Essequibo, the Orinoco, and the Rio Parima, once not only held sway as far as the Great Cataracts, but made incursions also into the Upper Orinoco, employing portages between the Pa ruspa* and the Caura, the Erevato and the Ventuari, the

* The Rio Paruspa fallz into the Rio Paragua, and the latter into the Rio Carony, which is one of the tributary streams of the Lower Orinoco.

Conorichite and the Atacavi. None knew better than the Caribs the intertwinings of the rivers, the proximity of the tributary streams, and the roads by which distances might be diminished. The Caribs had vanquished and almost exterminated the Cabres. Having made themselves masters of the Lower Orinoco, they met with resistance from the Guaypunaves, who had founded their dominion on the Upper Orinoco; and who, together with the Cabres, the Manitivitanos, and the Parenis, are the greatest cannibals of these countries. They originally inhabited the banks of the great river Inirida, at its confluence with the Chamochiquini, and the hilly country of Mabicore. About the year 1744, their chief, or as the natives call him, their king (apoto), was named Macapu. He was a man no less distinguished by his intelligence than his valour; had led a part of the nation to the banks of the Atabapo; and when the Jesuit Roman made his memorable expedition from the Orinoco to the Rio Negro, Macapu suffered that missionary to take with him some families of the Guaypunaves to settle them at Uruana, and near the cataract of Maypures. This people are connected by their language with the great branch of the Maypure nations. They are more industrious, we might also say more civilized, than the other nations of the Upper Orinoco. The missionaries relate, that the Guaypunaves, at the time of their sway in those countries, were generally clothed, and had considerable villages. After the death of Macapu, the command devolved on another warrior, Cuseru, called by the Spaniards El capitan Cusero. He established lines of defence on the banks of the Inirida, with a kind of little fort, constructed of earth and timber. The piles were more than sixteen feet high, and surrounded both the house of the apoto and a magazine of bows and arrows. These structures,

There is also an ancient portage of the Caribs between the Paruspa and the Rio Chavaro, which flows into the Rio Caura above the mouth of the Erevato. In going up the Erevato you reach the savannahs that are traversed by the Rio Manipiare above the tributary streams of the Ventuari. The Caribs in their distant excursions sometimes passed from the Rio Caura to the Ventuari, thence to the Padamo, and then by the Upper Orinoco to the Atacari, which, westward of Manuteso, takes the name of the Atabapo.
remarkable in a country in other respects so wild, have been described by Father Forneri.

The Marepizanas and the Manitivitanos were the preponderant nations on the banks of the Rio Negro. The former had for its chiefs, about the year 1750, two warriors called Imu and Cajamu. The king of the Manitivitanos was Cocuy, famous for his cruelty. The chiefs of the Guaypunaves and the Manitivitanos fought with small bodies of two or three hundred men; but in their protracted struggles they destroyed the missions, in some of which the poor monks had only fifteen or twenty Spanish soldiers at their disposal. When the expedition of Iturriaga and Solano arrived at the Orinoco, the missions had no longer to fear the incursions of the Caribs. Cuseru, the chief of the Guaypunaves, had fixed his dwelling behind the granitic mountains of Sipapo. He was the friend of the Jesuits; but other nations of the Upper Orinoco and the Rio Negro, led by Imu, Cajamu, and Cocuy, penetrated from time to time to the north of the Great Cataracts. They had other motives for fighting than that of hatred; they hunted men, as was formerly the custom of the Caribs, and is still the practice in Africa. Sometimes they furnished slaves (poitos) to the Dutch (in their language, Paranaquiri-inhabitants of the sea); sometimes they sold them to the Portuguese (Iaranavi-sons of musicians).* In America, as in Africa, the cupidity of the Europeans has produced the same evils, by exciting the natives to make war, in order to procure slaves. Everywhere the contact of nations, widely different from each other in the scale of civilization, leads to the abuse of physical strength, and of intellectual preponderance. The Phonicians and Carthaginians formerly sought slaves in Europe. Europe now presses in her turn both on the countries whence she gathered the first germs of science, and on those where she now almost involuntarily spreads them by carrying thither the produce of her industry.

I have faithfully recorded what I could collect on the

[^284]state of these countries, where the vanquished nations have become gradually extinct, leaving no other signs of their existence than a few words of their language, mixed with that of the conquerors. In the north, beyond the cataracts, the preponderant nations were at first the Caribs and the Cabres; towards the south, on the Upper Orinoco, the Guaypunaves; and on the Rio Negro, the Marepizanos and the Manitivitanos. The long resistance which the Cabres, united under a valiant chief, had made to the Caribs, became fatal to the latter subsequently to the year 1720. They at first vanquished their enemies near the mouth of the Rio Caura; and a great number of Caribs perished in a precipitate flight, between the rapids of Torno and the Isla del Infierno. The prisoners were devoured; and, by one of those refinements of cunning and cruelty which are common to the savage nations of both North and South America, the Cabres spared the life of one Carib, whom they forced to climb up a tree to witness this barbarous spectacle, and carry back the tidings to the vanquished. The triumph of Tep, the chief of the Cabres, was but of short duration. The Caribs returned in such great numbers that only a feeble remnant of the Cabres was left on the banks of the Cuchivero.

Cocuy and Cuseru were carrying on a war of extermination on the Upper Orinoco when Solano arrived at the mouth of the Guaviare. The former had embraced the cause of the Portuguese; the latter was a friend of the Jesuits, and gave them warning whenever the Manitivitanos were marching against the christian establishments of Atures and Carichana. Cuseru became a christian only a few days before his death; but in battle he had for some time worn on his left hip a crucifix, given him by the missionaries, and which he believed rendered him invulnerable. We were told an anecdote that paints the violence of his character. He had married the daughter of an Indian chief of the Rio Temi. In a paroxysm of rage against his father-in-law, he declared to his wife that he was going to fight against him. She reminded him of the courage and singular strength of her father; when Cuseru, without uttering a single word, took a poisoned arrow, and plunged it into her bosom. The arrival of a small body of Spaniards in

1756, under the order of Solano, awakened suspicion in this chief of the Guaypunaves. He was on the point of attempting a contest with them, when the Jesuits made him sensible that it would be his interest to remain at peace with the Christians. Whilst dining at the table of the Spanish general, Cuseru was allured by promises, and the prediction of the approaching fall of his enemies. From being a king he became the mayor of a village; and consented to settle with his people at the new mission of San Fernando de Atabapo. Such is most frequently the end of those chiefs whom travellers and missionaries style Indian princes. "In my mission," says the honest father Gili, "I had five reyecillos, or petty kings, those of the Tamanacs, the Avarigotes, the Parecas, the Quaquas, and the Maypures. At church I placed them in file on the same bench; but I took care to give the first place to Monaiti, king of the Tamanacs, because he had helped me to found the village; and he seemed quite proud of this precedency.

When Cuseru, the chief of the Gaaypunaves, saw the Spanish troops pass the cataracts, he advised Don Jose Solano to wait a whole year before he formed a settlement on the Atabapo; predicting the misfortunes which were not slow to arrive. "Let me labour with my people in clearing the ground," said Cuseru to the Jesuits; I will plant cassava, and you will find hereafter wherewith to feed all these men." Solano, impatient to advance, refused to listen to the counsel of the Indian chief, and the new inhabitants of San Fernando had to suffer all the evils of scarcity. Canoes were sent at a great expense to New Grenada, by the Meta and the Vichada, in search of flour. The provision arrived too late, and many Spaniards and Indians perished of those diseases which are produced in every climate by want and moral dejection.

Some traces of cultivation are still found at San Fernando. Every Indian has a small plantation of cacao-trees, which produce abundantly in the fifth year; but they cease to bear fruit sooner than in the valleys of Aragua. There are some savannahs and good pasturage round San Fernando, but hardly seven or eight cows are to be found, the remains of a considerable herd which was brought into these countries at
the expedition for settling the boundaries. The Indians an a little more civilized here than in the rest of the missions; and we found to our surprise a blacksmith of the native race.

In the mission of San Fernando, a tree which gives a peculiar physiognomy to the landscape, is the piritu or pirijao palm. Its trunk, armed with thorns, is more than sixty feet high; its leaves are pinnated, very thin, undulated, and frizzled towards the points. The fruits of this tree are very extraordinary; every cluster contains from fifty to eighty; they are yellow like apples, grow purple in proportion as they ripen, two or three inches thick, and generally, from abortion, without a kernel. Among the eighty or ninety species of palm-trees peculiar to the New Continent, which I have enumerated in the 'Nova Genera Plantarum Aquinoctialium,' there are none in which the sarcocarp is developed in a manner so extraordinary. The fruit of the pirijao furnishes a farinaceous substance, as yellow as the yolk of an egg, slightly saccharine, and extremely nutritious. It is eaten like plantains or potatoes, boiled or roasted in the ashes, and affords a wholesome and agreeable aliment. The Indians and the missionaries are unwearied in their praises of this noble palm-tree, which might be called the peachpalm. We found it cultivated in abundance at San Fernando, San Balthasar, Santa Barbara, and wherever we advanced towards the south or the east along the banks of the Atabapo and the Upper Orinoco. In those wild regions we are involuntarily reminded of the assertion of Linnæus, that the country of palm-trees was the first abode of our species, and that man is essentially palmivorous.* On examining the provision accumulated in the huts of the Indians, we perceive that their subsistence during several months of the year depends as much on the farinaceous fruit of the pirijao, as on the cassava and plantain. The tree bears fruit but once a year, but to the amount of three clusters, consequently from one hundred and fifty to two hundred fruits.

* Homo habitat intra tropicos, vescitur palmis, lotophagus; hospitatur extra tropicos sub novercante Cerere, carnivorus.-"Man dwells nalu. rally within the tropics, and lives on the fruits of the palm-tree; he eaists in other parts of the world, and there makes shift to feed on corn and flesh." (Syst. Nat., vol. i, p. 24.)

San Fernando de Atabapo, San Carlos, and San Francisco Solano, are the most considerable settlements among the missions of the Upper Orinoco. At San Fernando, as well as in the neighbouring villages of San Balthasar and Javita, the abodes of the priests are neatly-built houses, covered by lianas, and surrounded by gardens. The tall trunks of the pirijao palms were the most beautiful ornaments of these plantations. In our walks, the president of the mission gave us an animated account of his incursions on the Rio Guaviare. He related to us how much these journeys, undertaken "for the conquest of souls," are desired by the Indians of the missions. All, even women and old men, take part in them. Under the pretext of recovering neophytes who have deserted the village, children above eight or ten years of age are carried off, and distributed among the Indians of the missions as serfs, or poitos. According to the astronomical observations I took on the banks of the Atabapo, and on the western declivity of the Cordillera of the Andes, near the Paramo de la suma Paz, the distance is one hundred and seven leagues only from San Fernando to the first villages of the provinces of Caguan and San Juan de los Llanos. I was assured also by some Indians, who dwelt formerly to the west of the island of Amanaveni, beyond the confluence of the Rio Supavi, that going in a boat on the Guaviare (in the manner of the savages) beyond the strait (angostura) and the principal cataract, they met, at three days' distance, bearded and clothed men, who came in search of the eggs of the terekay turtle. This meeting alarmed the Indians so much, that they fled precipitately, redescending the Guaviare. It is probable, that these bearded white men came from the villages of Aroma and San Martin, the Rio Guaviare being formed by the union of the rivers Ariari and Guayavero. We must not be surprised that the missionaries of the Orinoco and the Atabapo little suspect how near they live to the missionaries of Mocoa, Rio Fragua, and Caguan. In these desert countries, the real distances can be known only by observations of the longitude. It was in consequence of astronomical data, and the information I gathered in the convents of Popayan and of Pasto, to the west of the Cordillera of the Andes, that I formed an accurate idea of the respective

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situations of the christian settlements on the Atabapo, the Guayavero, and the Caqueta.*

Everything changes on entering the Rio Atabapo; the constitution of the atmosphere, the colour of the waters, and the form of the trees that cover the shore. You no longer suffer during the day the torment of mosquitos; and the longlegged gaats (zancudos) become rare during the night. Beyond the mission of San Fernando these nocturnal insects disappear altogether. The water of the Orinoco is turbid, and loaded with earthy matter; and in the coves, from the accumulation of dead crocodiles and other putrescent substances, it diffuses a musky and faint smell. We were sometimes obliged to strain this water through a linen cloth before we drank it. The water of the Atabapo, on the contrary, is pure, agreeable to the taste, without any trace of smell, brownish by reflected, and of a pale yellow by transmitted light. The people call it light, in opposition to the heavy and turbid waters of the Orinoco. Its temperature is generally two degrees, and when you approach the mouth of the Rio Temi, three degrees, cooler than the temperature of the Upper Orinoco. After having been compelled during a whole year to drink water at $27^{\circ}$ or $28^{\circ}$, a lowering of a few degrees in the temperature produces a very agreeable sensation. I think this lowering of the temperature may be attributed to the river being less broad, and without the sandy beach, the heat of which, at the Orinoco, is by day more than $50^{\circ}$, and also to the thick shade of the forests which are traversed by the Atabapo, the Temi, the Tuamini, and the Guainia, or Rio Negro.

The extreme purity of the black waters is proved by their limpidity, their transparency, and the clearness with which they reflect the images and colours of surrounding objects. The smallest fish are visible in them at a depth of twenty or thirty feet; and most commonly the bottom of the river may be distinguished, which is not a yellowish or brownish mud, like the colour of the water, but a quartzose and granitic sand of dazzling whiteness. Nothing can be compared to the beauty of the banks of the Atabapo. Loaded with plants, among which rise the palms with feathery leaves; the banks are reflected in the waters, and this

- The Caqueta bears, lower down, the name of the Yupurà.
reflex verdure seems to have the same vivid hue as that which clothes the real vegetation. The surface of the fluid is homogeneous, smooth, and destitute of that mixture of suspended sand and decomposed organic matter, which roughens and streaks the surface of less limpid rivers.

On quitting the Orinoco, several small rapids must be passed, but without any appearance of danger. Amid these raudalitos, according to the opinion of the missionaries, the Rio Atabapo falls into the Orinoco. I am however disposed to think that the Atabapo falls into the Guaviare. The Rio Guaviare, which is much wider than the Atabapo, has white waters, and in the aspect of its banks, its fishing-birds, its fish, and the great crocodiles which live in it, resembled the Orinoco much more than that part of the Atabapo which comes from the Esmeralda. When a river springs from the junction of two other rivers, nearly alike in size, it is difficult to judge which of the two confluent streams must be regarded as its source. The Indians of San Fernando affirm that the Orinoco rises from two rivers, the Guaviare and the Rio Paragua. They give this latter name to the Upper Orinoco, from San Fernando and Santa Barbara to beyond the Esmeralda, and they say that the Cassiquiare is not an arm of the Orinoco, but of the Rio Paragua. It matters but little whether or not the name of Orinoco be given to the Rio Paragua, provided we trace the course of these rivers as it is in nature, and do not separate by a chain of mountains, (as was done previously to my travels,) rivers that communicate together, and form one system. When we would give the name of a large river to one of the two branches by which it is formed, it should be applied to that branch which furnishes most water. Now, at the two seasons of the year when I saw the Guaviare and the Upper Orinoco or Rio Paragua (between the Esmeralda and San Fernando), it appeared to me that the latter was not so large as the Guaviare. Similar doubts have been entertained by geographers respecting the junction of the Upper Mississippi with the Missouri and the Ohio, the junction of the Marañon with the Guallaga and the Ucayale, and the junction of the Indus with the Chunab (Hydaspes of Cashmere) and the Gurra, or Sutlej.* To

* The Hydaspes is properly a tributary stream of the Chunab or $\geq 2$
avoid embroiling farther a nomenclature of rivers so arbitrarily fixed, I will not propose new denominations. I shall continue, with Father Caulin and the Spanish geographers, to call the river Esmeralda the Orinoco, or Upper Orinoco; but I must observe that if the Orinoco, from San Fernando de Atabapo as far as the delta which it forms opposite the island of Trinidad, were regarded as the continuance of the Rio Guaviare; and if that part of the Upper Orinoco between the Esmeralda and the mission of Ban Fernando were considered a tributary stream; the Orinoco would preserve, from the savannahs of San Juan de los Llanos and the eastern declivity of the Andes to its mouth, a more uniform and natural direction, that from south-west to north-east.

The Rio Paragua, or that part of the Orinoco east of the mouth of the Guaviare, has clearer, more transparent, and purer water than the part of the Orinoco below San Fernando. The waters of the Guaviare, on the contrary, are white and turbid; they have the same taste, according to the Indians, (whose organs of sense are extremely delicate and well practised,) as the waters of the Orinoco near the Great Cataracts. "Bring me the waters of three or four great rivers of these countries," an old Indian of the mission of Javita said to us; "on tasting each of them I will tell you, without fear of mistake, whence it was taken; whether it comes from a white or black river; the Orinoco or the Atabapo, the Paragua or the Guaviare." The great crocodiles and porpoises (toninas) which are alike common in the Rio Guaviare and the Lower Orinoco, are entirely wanting, as we were told, in the Rio Paragua (or Upper Orinoco, between San Fernando and the Esmeralda). These are very remarkable differences in the nature of the waters, and the distribution of animals. The Indians do not fail to mention them, when they would prove to travellers that the Upper Orinoco, to the east of San Fernando, is a distinct river which falls into the Orinoco, and that the real origin of the latter must be sought in the sources of the Guaviare.
Acesines. The Sutlej or Hysudrus forms, together with the Beyah or Hyphases, the river Gurra. These are the beautiful regions of the Punjab and Douab, celebrated from the time of Alexander to the present day.

The astronomical observations made in the night of the 25th of April did not give me the latitude with satisfactory precision. The latitude of the mission of San Fernando appeared to me to be $4^{\circ} 2^{\prime} 48^{\prime \prime}$. In Father Caulin's map, founded on the observations of Solano made in 1756, it is $4^{\circ} 1^{\prime}$. This agreement proves the justness of a result which, however, I could only dedúce from altitudes considerably distant from the meridian. A good observation of the stars at Guapasoso gave me $4^{\circ} 2^{\prime}$ for San Fernando de Atabapo. I was able to fix the longitude with much more precision in my way to the Rio Negro, and in returning from that river. It is $70^{\circ} 30^{\prime} 46^{\prime \prime}$ (or $4^{\circ} 0^{\prime}$ west of the meridian of Cumana).

On the 26th of April we advanced only two or three leagues, and passed the night on a rock near the Indian plantations or conucos of Guapasoso. The river losing itself by its inundations in the forests, and its real banks being unseen, the traveller can venture to land only where a rock or a small table-land rises above the water. The granite of those countries, owing to the position of the thin laminæ of black mica, sometimes resembles graphic granite ; but most frequently (and this determines the age of its formation) it passes into a real gneiss. Its beds, very regularly stratified, run from south-west to north-east, as in the Cordillera on the shore of Caracas. The dip of the granitegneiss is $70^{\circ}$ north-west. It is traversed by an infinite number of veins of quartz, which are singularly transparent, and three or four, and sometimes fifteen inches thick. I found no cavity (druse), no crystallized substance, not even rock-crystal ; and no trace of pyrites, or any other metallic substance. I enter into these particulars on account of the chimerical ideas that have been spread ever since the sixteenth century, after the voyages of Berreo and Raleigh,* "on the immense riches of the great and fine empire of Guiana."
The river Atabapo presents throughout a peculiar aspect; you see nothing of its real banks formed by flat lands eight

* Raleigh's work bears the high sounding title of "The Discovery of the large, rich, and beautiful Empire of Guiana." (Lond. 1596.) See also Raleghi admiranda Descriptio Regni Guianse, auri abundantissimi. (Hondius, Noriberga, 1599.)
or ten feet high; they are concealed by a row of palms, and small trees with slender trunks, the roots of which are bathed by the waters. There are many crocodiles from the point where you quit the Orinoco to the mission of San Fernando, and their presence indicates that this part of the river belongs to the Rio Guaviare and not to the Atabapo. In the real bed of the latter river, 'above the mission of San Fernando, there are no crocodiles: we find there some bavas, a great many fresh-water dolphins, but no manatis. We also seek in vain on these banks for the thicknosed tapir, the araguato, or great howling monkey, the zamuro, or Vultur aura, and the crested pheasant, known by the name of guacharaca. Enormous water-snakes, in shape resembling the boa, are unfortunately very common, and are dangerous to Indians who bathe. We saw them almost from the first day we embarked, swimming by the side of our canoe; they were at most twelve or fourteen feet long. The jaguars of the banks of the Atabapo and the Temi are large and well fed; they are said, however, to be less daring than the jaguars of the Orinoco.

The night of the 27th was beautiful; dark clouds passed from time to time over the zenith with extreme rapidity. Not a breath of wind was felt in the lower strata of the atmosphere; the breeze was at the height of a thousand toises. I dwell upon this peculiarity ; for the movement we saw was not produced by the counter-currents (from west to east) which are sometimes thought to be observed in the torrid zone on the loftiest mountains of the Cordilleras; it was the effect of a real breeze, an east wind. We left the conucos of Guapasoso at two o'clock; and continued to ascend the river toward the south, finding it (or rather that part of its bed which is free from trees) growing more and more narrow. It began to rain toward sunrise. In these forests, which are less inhabited by animals than those of the Orinoco, we no longer heard the howlings of the monkeys. The dolphins, or toninas, sported by the side of our boat. According to the relation of Mr. Colebrooke, the Delphinus gangeticus, which is the fresh-water porpoise of the Old World, in like manner accompanies the boats that go up towards Benares; but from Benares to the point where the Ganges receives the salt waters is only two hun-
dred leagues, while from the Atabapo to the mouth of the Orinoco is more than three hundred and twenty.

About noonwe passed the mouth of the little river Ipurichapano on the east, and afterwards the granitic rock, known by the name of Piedra del Tigre. Between the fourth and fifth degrees of latitude, a little to the south of the mountains of Sipapo, we reach the southern extremity of that chain of cataracts, which I proposed, in a memoir published in 1800, to call the Chain of Parima. At $4^{\circ} 20^{\prime}$ it stretches from the right bank of the Orinoco toward the east and east-southeast. The whole of the land extending from the mountains of the Parima towards the river Amazon, which is traversed by the Atabapo, the Cassiquiare, and the Rio Negro, is an immense plain, covered partly with forests, and partly with grass. Small rocks rise here and there like castles. We regretted that we had not stopped to rest near the Piedra del Tigre; for on going up the Atabapo we had great difficulty to find a spot of dry ground, open and spacious enough to light a fire, and place our instrument and our hammocks.

On the 28th of April, it rained hard after sunset, and we were afraid that our collections would be damaged. The poor missionary had his fit of tertian fever, and besought us to re-embark immediately after midnight. We passed at day-break the Piedra and the Raudalitos* of Guarinuma. The rock is on the east bank; it is a shelf of granite, covered with psora, cladonia, and other lichens. I could have fancied myself transported to the north of Europe, to the ridge of the mountains of gneiss and granite between Freiberg and Marienberg in Saxony. The cladonias appeared to me to be identical with the Lichen rangiferinus, the L. pixidatus, and the L. polymorphus of Linnæus. After having passed the rapids of Guarinuma, the Indians showed us in the middle of the forest, on our right, the ruins of the mission of Mendaxari, which has been long abandoned. On the east bank of the river, near the little rock of Kemarumo, in the midst of Indian plantations, a gigantic bombax $\dagger$ attracted our curiosity. We landed to measure it ; the height was nearly one hundred and twenty feet, and the diameter between fourteen and fifteen. This enormous specimen of

[^285]vegetation surprised us the more, as 'we had till then seen on the banks of the Atabapo only small trees with slender trunks, which from afar resembled young cherry-trees. The Indians assured that these small trees do not form a very extensive group. They are checked in their growth by the inundations of the river; while the dry grounds near the Atabapo, the Temi, and the Tuamini, furnish excellent timber for building. These forests do not stretch indefinitely to the east and west, toward the Cassiquiare and the Guaviare ; they are bounded by the open savannahs of Manuteso, and the Rio Inirida. We found it difficult in the evening to stem the current, and we passed the night in a wood a little above Mendaxari; which is another granitic rock traversed by a stratum of quartz. We found in it a group of fine crystals of black schorl.

On the 29th, the air was cooler. We had no zancudos, but the sky was constantly clouded, and without stars. I began to regret the Lower Orinoco. We still advanced but slowly from the force of the current, and we stopped a great part of the day to seek for plants. It was night when we arrived at the mission of San Balthasar, or, as the monks style it, the mission of la divina Pastora de Balthasar de Atabapo. We were lodged with a Catalonian missionary, a lively and agrecable man, who displayed in these wild countries the activity that characterises his nation. He had planted a garden, where the fig-tree of Europe was found in company with the persea, and the lemon-tree with the mammee. The village was built with that regularity which, in the north of Germany, and in protestant America, we find in the hamlets of the Moravian brethren; and the Indian plantations seemed better cultivated than elsewhere. Here we saw for the first time that white and fungous substance which I have made known by the name of dapicho and zapis.* We immediately perceived that it was analogous to india-rubber; but, as the Indians made us understand by signs, that it was found underground, we were inclined to think, till we arrived at the mission of Javita, that the dapicho was a fossil caoutchouc, though different from the elastic bitumen of Derbyshire. A Poimisano Indian, seated by the fire in the hut of

[^286]the missionary, was employed in reducing the dapicho into black caoutchouc. He had spited several bits on a slender stick, and was roasting them like meat. The dapicho blackens in proportion as it grows soft, and becomes elastic. The resinous and aromatic smell which filled the hut, seemed to indicate that this coloration is the effect of the decomposition of a carburet of hydrogen, and that the carbon appears in proportion as the hydrogen burns at a low heat. The Indian beat the softened and blackened mass with a piece of brazil-wood, formed at one end like a club; he then kneaded the dapicho into balls of three or four inches in diameter, and let it cool. These balls exactly resemble the caoutchouc of the shops, but their surface remains in general slightly viscous. They are used at San Balthasar in the Indian game of tennis, which is celebrated among the inhabitants of Uruana and Encaramada; they are also cut into cylinders, to be used as corks, and are far preferable to those made of the bark of the cork-tree.

This use of caoutchouc appeared to us the more worthy notice, as we had been often embarrassed by the want of European corks. The great utility of cork is fully understood in countries where trade has not supplied this bark in plenty. Equinoctial America nowhere produces, not even on the back of the Andes, an oak resembling the Quercus suber; and neither the light wood of the bombax, the ochroma, and other malvaceous plants, nor the rhachis of maize, of which the natives make use, can well supply the place of our corks. The missionary showed us, before the Casa de los Solteros (the house where the young unmarried men reside), a drum, which was a hollow cylinder of wood, two feet long and eighteen inches thick. This drum was beaten with great masses of dapicho, which served as drumsticks; it had openings which could be stopped by the hand at will, to vary the sounds, and was fixed on two light supports. Savage notions love noisy music ; the drum and the botuto, or trumpet of baked earth, in which a tube of three or four feet long communicates with several barrels, are indispensable instruments among the Indians for their grand pieces of music.

The night of the 30th of April was sufficiently fine for observing the meridian heights of $\chi$ of the Southern Cross,
and the two large stars in the feet of the Centuar. I found the latitude of San Balthasar $3^{\circ} 14^{\prime} 23^{\prime \prime}$. Horary angles of the sun gave $70^{\circ} 14^{\prime} 21^{\prime \prime}$ for the longitude by the chronometer. The dip of the magnetic needle was $27.8^{\circ}$ (cent. div.) We left the mission at a late hour in the moming, and continued to go up the Atabapo for five miles; then, instead of following that river to its source in the east, where it bears the name of Atacavi, we entered the Rio Temi. Before we reached its confluence, a granitic eminence on the western bank, near the mouth of the Guasacavi, fixed our attention: it is called Piedra de la Guahiba, (Rock of the Guahiba woman), or the Piedra de la Madre (Mother's Rock.) We inquired the cause of so singular a denomination. Father Zea could not satisfy our curiosity; but some weeks after, another missionary, one of the predecessors of that ecclesiastic, whom we found settled at San Fernando as president of the missions, related to us an event which excited in our minds the most painful feelings. If, in these solitary scenes, man scarcely leaves behind him any trace of his existence, it is doubly humiliating for a European to see perpetuated by so imperishable a monument of nature as a rock, the remembrance of the moral degradation of our species, and the contrast between the virtue of a savage, and the barbarism of civilized man!

In 1797 the missionary of San Fernando had led his Indians to the banks of the Rio Guaviare, on one of those hostile incursions which are prohibited alike by religion and the Spanish laws. They found in an Indian hut a Guahiba women with her three children (two of whom were still infants), occupied in preparing the flour of cassava. Resistance was impossible; the father was gone to fish, and the mother tried in vain to flee with her children. Scarcely had she reached the savannah when she was seized by the Indians of the mission, who hunt human beings, like the Whites and the Negroes in Africa. The mother and her children were bound, and dragged to the bank of the river. The monk, seated in his boat, waited the issue of an expedition of which he shared not the danger. Had the mother made too violent a resistance the Indians would have killed her, for everything is permitted for the sake of the conquest of souls (la conquista espirituel), and it is particularly
desirable to capture children, who may be treated in the mission as poitos, or slaves of the Christians. The prisoners were carried to San Fernando, in the hope that the mother would be unable to find her way back to her home by land. Separated from her other children who had accompanied their father on the day in which she had been carried off, the unhappy woman showed signs of the deepest despair. She attempted to take back to her home the children who had been seized by the missionary; and she fled with them repeatedly from the village of San Fernando. But the Indians never failed to recapture ber; and the missionary, after having caused her to be mercilessly beaten, took the cruel resolution of separating the mother from the two children who had been carried off with her. She was conveyed alone to the missions of the Rio Negro, going up the Atabapo. Slightly bound, she was seated at the bow of the boat, ignorant of the fate that awaited her; but she judged by the direction of the sun, that she was removing farther and farther from her hut and her native country. She succeeded in breaking her bonds, threw herself into the water, and swam to the left bank of the Atabapo. The current carried her to a shelf of rock, which bears her name to this day. She landed and took shelter in the woods, but the president of the missions ordered the Indians to row to the shore, and follow the traces of the Guahiba. In the evening she was brought back. Stretched upon the rock (la Piedra de la Madre) a cruel punishment was inflicted on her with those straps of manati leather, which serve for whips in that country, and with which the alcaldes are always furnished. This unhappy woman, her hands tied behind her back with strong stalks of mavacure, was then dragged to the mission of Javita.

She was there thrown into one of the caravanserais, called las Casas del Rey. It was the rainy season, and the night was profoundly dark. Forests till then believed to be impenetrable separated the mission of Javita from that of San Fernando, which was twenty-five leagues distant in a straight line. No other route is known than that by the rivers; no man ever attempted to go by land from one village to another. But such difficulties could not deter a mother, separated from her children. The Guahiba was
carelessly gaarded in the caravanserai. Her arms being wounded, the Indians of Javita had loosened her bonds, unknown to the missionary and the alcaldes. Having succeeded by the help of her teeth in breaking them entirely, she disappeared during the night; and at the fourth sunrise was seen at the mission of San Fernando, hovering around the hut where her children were confined. "What that woman performed," added the missionary, who gave us this sad narrative, "the most robust Indian would not have ventured to undertake!" She traversed the woods at a season when the sky is constantly covered with clouds, and the sun during whole days appears but for a few minutes. Did the course of the waters direct her way? The inundations of the rivers forced her to go far from the banks of the main stream, through the midst of woods where the movement of the water is almost imperceptible. How often must she have been stopped by the thorny lianas, that form a network around the trunks they entwine! How often must she have swum across the rivulets that run into the Atabapo! This unfortunate woman was asked how she had sustained herself during four days. She said that, exhausted with fatigue, she could find no other nourishment than those great black ants called vachacos, which climb the trees in long bands, to suspend on them their resinous nests. We pressed the missionary to tell us whether the Guahiba had peacefully enjoyed the happiness of remaining with her children; and if any repentance had followed this excess of cruelty. He would not satisfy our curiosity; but at our return from the Rio Negro we learned that the Indian mother was again separated from her children, and sent to one of the missions of the Upper Orinoco. There she died, refusing all kind of nourishment, as savages frequently do in great calamities.

Such is the remembrance annexed to this fatal rock, the Piedra de la Madre. In this relation of my travels I feel no desire to dwell on pictures of individual sufferingevils which are frequent wherever there are masters and slaves. civilized Europeans living with people in a state of barbarism, and priests exercising the plenitude of arbitrary power over men ignorant and without defence. In describing the countries through which I passed, I generally confine
myself to pointing out what is imperfect, or fatal to humanity, in their civil or religious institutions. If I have dwelt longer on the Rook of the Guahiba, it was to record an affecting instance of maternal tenderness in a race of people so long calumniated; and because I thought some benefit might accrue from publishing a fact, which I had from the monks of San Francisco, and which proves how much the system of the missions calls for the care of the legislator.

Above the mouth of the Guasucavi we entered the Rio Temi, the course of which is from south to north. Had we continued to ascend the Atabapo, we should have turned to east-south-east, going farther from the banks of the Guainia or Rio Negro. The Temi is only eighty or ninety toises broad, but in any other country than Guiana it would be a considerable river. The country exhibits the uniform aspect of forests covering ground perfectly flat. The fine pirijao palm, with its fruit like peaches, and a new species of bache, or mauritia, its trunk bristled with thorns, rise amid smaller trees, the vegetation of which appears to be retarded by the continuance of the inundations. The Mauritia aculeata is called by the Indians juria or cauvaja; its leaves are in the form of a fan, and they bend towards the ground. At the centre of every leaf, no doubt from the effect of some disease of the parenchyma, concentric circles of alternate blue and yellow appear, the yellow prevailing towards the middle. We were singularly struck by this appearance; the leaves, coloured like the peacock's tail, are supported by short and very thick trunks. The thorns are not slender and long like those of the corozo and other thorny palm-trees; but on the contrary, very woody, short, and broad at the base, like the thorns of the Hura crepitans. On the banks of the Atabapo and the Temi, this palm-tree is distributed in groups of twelve or fifteen stems, close together, and looking as if they rose from the same root. These trees resemble in their appearance, form, and scarcity of leaves, the fan-palms and palmettos of the Old World. We remarked that some plants of the juria were entirely destitute of fruit, and others exhibited a considerable quantity; this circumstance seems to indicate a palm-tree of separate sexes.

Wherever the Rio Temi forms coves, the forest is inun-
dated to the extent of more than half a square league. To avoid the sinuosities of the river and shorten the passage, the navigation is here performed in a very extraordinary manner. The Indians made us leave the bed of the river; and we proceeded southward across the forest, through paths (sendas), that is, through open channels of four or five feet broad. The depth of the water seldom exceeds half a fathom. These sendas are formed in the inundated forest like paths on dry ground. The Indians, in going from one mission to another, pass with their boats as much as possible by the same way; but the communications not being frequent, the force of vegetation sometimes, produces unexpected obstacles. An Indian, furnished with a machete (a great knife, the blade of which is fourteen inches long), stood at the head of our boat, employed continually in chopping off the branches that crossed each other from the two sides of the channel. In the thickest part of the forest we were astonished by an extraordinary noise. On beating the bushes, a shoal of toninas (fresh-water dolphins) four feet long, surrounded our boat. These animals had concealed themselves beneath the branches of a fromager, or Bombax ceiba. They fled across the forest, throwing out those spouts of compressed air and water which have given them in every language the name of 'blowers.' How singular was this spectacle in an inland spot, three or four hundred leagues from the mouths of the Orinoco and the Amazon! I am aware that the pleuronectes (dabs) of the Atlantic go up the Loire as far as Orleans; but I am, nevertheless, of opinion that the dolphins of the Temi, like those of the Ganges, and like the skate (raia) of the Orinoco, are of a species essentially different from the dolphins and skates of the ocean. In the immense rivers of South America, and the great lakes of North America, nature seems to repeat several pelagic forms. The Nile has no porpoises:* those of the sea go up the Delta no farther than Biana and Metonbis towards Selamoun.

At five in the evening we regained with some difficulty

[^287]the bed of the river. Our canoe remained fast for some minutes between two trunks of trees; and it was no sooner disengaged than we reached a spot where several paths, or small channels, crossed each other, so that the pilot was puzzled to distinguish the most open path. We navigated through a forest so thick that we could guide ourselves neither by the sun nor by the stars. We were again struck during this day by the want of arborescent ferns in that country ; they diminish visibly from the sixth degree of north latitude, while the palm-trees augment prodigiously towards the equator. Fern-trees belong to a climate less hot, and a soil but little mountainous. It is only where there are mountains that these majestic plants descend towards the plains; they seem to avoid perfectly flat grounds, as those through which run the Cassiquiare, the Temi, Inirida, and the Rio Negro. We passed in the night near a rock, called the Piedra de Astor by the missionaries. The ground from the mouth of the Guaviare constantly displays the same geological formation. It is a vast granitic plain, in which from league to league the rock pierces the soil, and forms, not hillocks, but small masses, that resemble pillars or ruined buildings.

On the 1st of May the Indians chose to depart long before sunrise. We were stirring before them, however, because I waited (though vainly) for a star ready to pass the meridian. In those humid regions covered with forests, the nights became more obscure in proportion as we drew nearer to the Rio Negro and the interior of Brazil. We remained in the bed of the river till daybreak, being afraid of losing ourselves among the trees. At sunrise we again entered the inundated forest, to avoid the force of the current. On reaching the junction of the Temi with another little river, the Tuamini, the waters of which are equally black, we proceeded along the latter to the southwest. This direction led us near the mission of Javita, which is founded on the banks of the Tuamini; and at this christian settlement we were to find the aid necessary for transporting our canoe by land to the Rio Negro. We did not arrive at San Antonio de Javita till near eleven in the morning. An accident, unimportant in itself, but which shows the excessive timidity of the little sagoins,
detained us some time at the mouth of the Tuamini. The noise of the blowers had frightened our monkeys, and one of them fell into the water. Animals of this species, perhaps on account of their extreme meagreness, swim badly; and consequently it was saved with some difficulty.

At Javita we had the pleasure of finding a very intelligent and obliging monk, at whose mission we were forced to remain four or five days, the time required for transporting our boat across the portage of Pimichin. This delay enabled us to visit the surrounding country, as also to relieve ourselves from an annoyance which we had suffered for two days. We felt an extraordinary irritation on the joints of our fingers, and on the backs of our hands. The missionary told us it was caused by the aradores,* which get under the skin. We could distinguish with a lens nothing but streaks, or parallel and whitish furrows. It is the form of these furrows, that has obtained for the insect the name of 'ploughman.' A mulatto woman was sent for, who professed to be thoroughly acquainted with all the little insects that burrow in the human skin ; the chego, the nuche, the coya, and the arador; she was the curandera, or surgeon of the place. She promised to extirpate, one by one, the insects which caused this smarting irritation, Having heated at a lamp the point a little bit of hard wood, she dug with it into the furrows that marked the skin. After long examination, she announced with the pedantic gravity peculiar to the mulatto race, that an arador was found. I saw a little round bag, which I suspected to be the egg of an acarus. I was to find relief when the mulatto woman had succeeded in taking out three or four of these aradores. Having the skin of both hands filled with acari, I had not the patience to wait the end of an operation, which had already lasted till late at night. The next day an Indian of Javita cured us radically, and with surprising promptitude. He brought us the branch of a shrub, called uzao, with small leaves like those of cassia, very coriaceous and glossy. He made a cold infusion of the bark of this shrub, which had a bluish colour, and the taste of liquorice. When beaten, it yields a great deal of froth. The irritation of the aradores ceased by using simple lotions of this uzao-water. We could not find this

[^288]shrub in flower, or bearing fruit; it appears to belong to the family of the leguminous plants, the chemical properties of which are singularly varied. We dreaded so much the sufferings to which we had been exposed, that we constantly kept some branches of the uzao in our boat, till we reached San Carlos. This shrub grows in abundance on the banks of the Pimichin. Why has no remedy been discovered for the irritation produced by the sting of the zancudos, as well as for that occasioned by the aradores or microscopic acari?

In 1755, before the expedition for fixing the boundaries, better known by the name of the expedition of Solano, the whole country between the missions of Javita and San Balthasar was regarded as dependent on Brazil. The Portuguese had advanced from the Rio Negro, by the portage of the Caño Pimichin, as far as the banks of the Temi. An Indian chief of the name of Javita, celebrated for his courage and his spirit of enterprise, was the ally of the Portuguese. He pushed his hostile incursions from the Rio Jupura, or Caqueta, one of the great tributary streams of the Amazon, by the rivers Uaupe and Xiè, as far as the black waters of the Temi and the Tuamini, a distance of more than a hundred leagues. He was furnished with letters patent, which authorised him "to bring the Indians from the forest, for the conquest of souls." He availed himself amply of this permission; but his incursions had an object which was not altogether spiritual, that of making slaves to sell to the Portuguese. When Solano, the second chief of the expedition of the boundaries, arrived at San Fernando de Atabapo, he had Javita seized, in one of his incursions to the banks of the Temi. He treated him with gentleness, and succeeded in gaining him over to the interests of the Spanish government by promises that were not fulfilled. The Portuguese, who had already formed some stable settlements in these countries, were driven back as far as the lower part of the Bio Negro; and the mission of San Antonio, of which the more usual name is Javita, so called after its Indian founder, was removed farther north of the sources of the Tuamini, to the spot where it is now established. This captain, Javita, was still living, at an advanced age, when we proceeded to the Rio Negro. He was an Indian of great vigour of mind and body. He spoke Spanish with facility, and preserved a certain

[^289]influence over the neighbouring nations. As he attended us in all our herborizations, we obtained from his own mouth information so much the more useful, as the missionaries have great confidence in his veracity. He assured us, that in his youth he had seen almost all the Indian tribes, that inhabit the vast regions between the Upper Orinoco, the Rio Negro, the Inirida, and the Jupura, eat human flesh. The Daricavanas, the Puchirinavis, and the Manitivitanos, appeared to him to be the greatest cannibals among them. He believes that this abominable practice is with them the effect of a system of vengeance; they eat only enemies who are made prisoners in battle. The instances where, by a refinement of cruelty, the Indian eats his nearest relations, his wife, or an unfaithful mistress, are extremely rare. The strange custom of the Scythians and Massagetes, the Capanaguas of the Rio Ucayale, and the ancient inhabitants of the West Indian Islands, of honouring the dead by eating a part of their remains, is unknown on the banks of the Orinoco. In both continents this trait of manners belongs only to nations that hold in horror the flesh of a prisoner. The Indian of Hayti (Saint Domingo) would think himself wanting in regard to the memory of a relation, if he did not throw into his drink a small portion of the body of the deceased, after having dried it like one of the mummies of the Guanches, and reduced it to powder. This gives us just occasion to repeat with an eastern poet, "of all animals man is the most fantastic in his manners, and the most disorderly in his propensities."

The climate of the mission of San Antonio de Javita is extremely rainy. When you have passed the latitude of three degrees north, and approach the equator, you have seldom an opportunity of observing the sun or the stars. It rains almost the whole year, and the sky is constantly cloudy. As the breeze is not felt in these immense forests of Guiana, and the refluent polar currents do not penetrate them, the column of air which reposes on this wooded zone is not renewed by dryer strata. It is saturated with vapours which are condensed into equatorial rains. The missionary assured us that it often rains here four or five months without cessation.

The temperature of Javita is cooler than that of Maypures,
buit considerably hotter than that of the Guainia or Rio Negro. The centigrade thermometer kept up in the day to twenty-six or twenty-seven degrees; and in the night to twenty-one degrees.

From the 30th of April to the 11th of May, I had not been able to see any star in the meridian so as to determine the latitude of places. I watched whole nights in order to make use of the method of double altitudes; but all my efforts were useless. The fogs of the north of Europe are not more constant than those of the equatorial regions of Guiana. On the 4th of May, I saw the sun for some minutes; and found by the chronometer and the horary angles the longitude of Javita to be $70^{\circ} 22^{\prime}$, or $1^{\circ} 15^{\prime}$ farther west than the longitude of the junction of the Apure with the Orinoco. This result is interesting for laying down on our maps the unknown country lying between the Xiè and the sources of the Issana, situated on the same meridian with the mission of Javita.

The Indians of Javita, whose number amounts to one hundred and sixty, now belong for the most part to the nations of the Poimisanos, the Echinavis, and the Paraganis. They are employed in the construction of boats, formed of the trunks of sassafras, a large species of laurel, hollowed by means of fire and the hatchet. These trees are more than one hundred feet high; the wood is yellow, resinous, almost incorruptible in water, and has a very agreeable smell. We saw them at San Fernando, at Javita, and more particularly at Esmeralda, where most of the canoes of the Orinoco are constructed, because the adjacent forests furnish the largest trunks of sassafras.

The forest between Javita and the Caifo Pimichin, contains an immense quantity of gigantic trees, ocoteas, and laurels, the Amasonia arborea," the Retiniphyllum secundiflorum, the curvana, the jacio, the iacifate, of which the wood is red like the brazilletto, the guamufate, with its fine leaves of

[^290]calophyllum from seven to eight inches long, the Amyris caraña, and the mani. All these trees (with the exception of our new genus Retiniphyllum) were more than one hundred or one hundred and ten feet high. As their trunks throw out branches only toward the summit, we had some trouble in procuring both leaves and flowers. The latter were frequently strewed upon the ground at the foot of the trees; but, the plants of different families being grouped together in these forests, and every tree being covered with lianas, we could not, with any degree of confidence, rely on the authority of the natives, when they assured us that a flower belonged to such or such a tree. Amid these riches of nature heborizations caused us more chagrin than satisfaction. What we could gather appeared to us of little interest, compared to what we could not reach. It rained unceasingly during several months, and M. Bonpland lost the greater part of the specimens which he had been compelled to dry by artificial heat. Our Indians distinguished the leaves better than the corollw or the fruit. - Occupied in seeking timber for canoes, they are inattentive to flowers. "All those great trees bear neither flowers nor fruits," they repeated unceasingly. Like the botanists of antiquity, they denied what they had not taken the trouble to observe. They were tired with our questions, and exhausted our patience in return.

We have already mentioned that the same chemical properties being sometimes found in the same organs of different families of plants, these families supply each other's places in various climates. Several species of palms* furnish the inhabitants of equinoctial America and Africa with the ol which we derive from the olive. What the conifere are to the temperate zone, the terebinthacem and the guttiferm are to the torrid. In the forests of those burning climates,

* In Africa, the elais or maba; in America the cocoa-tree. In the cocoa-tree it is the perisperm; and in the elais (as in the olive, and the oleineæ in general) it is the sarcocarp, or the pulp of the pericarp, that yields oil. This difference, observed in the same family, appears to me very remarkable, though it is in no way contradictory to the results obtained by De Candolle in his ingenious researches on the chemical properties of plants. If our Alfonsia oleifera belong to the genus Elais, (as Brown, with great reason believes,) it follows, that in the same genus the oil is found in the sarcocarp and in the perisperm.
(where there is neither pine, thuya, taxodium, nor even a podocarpus,) resins, balsams, and aromatic gums, are furnished by the maronobea, the icica, and the amyris. The collecting of these gummy and resinous substances is a trade in the village of Javita. The most celebrated resin bears the name of mani; and of this we saw masses of several hundred-weight, resembling colophony and mastic. The tree called mani by the Paraginis, which M. Bonpland believes to be the Moronobæa coccinea, furnishes but a small quantity of the substance employed in the trade with Angostura. The greatest part comes from the mararo or caragna, which is an amyris. It is remarkable enough, that the name mani, which Aublet heard among the Galibis* of Cayenne, was again heard by us at Javita, three hundred leagues distant from French Guiana. The moronobæa or symphonia of Javita yields a yellow resin; the caragna, a resin strongly odoriferous, and white as snow; the latter beomes yellow where it is adherent to the internal part of old bark.

We went every day to see how our canoe advanced on the portages. Twenty-three Indians were employed in dragging it by land, placing branches of trees to serve as rollers. In this manner a small boat proceeds in a day or a day and a half, from the waters of the Tuamini to those of the Caño Pimichin, which flow into the Rio Negro. Our canoe being very large, and having to pass the cataracts a second time, it was necessary to avoid with particular care any friction on the bottom; consequently the passage occupied more than four days. It is only since 1795 that a road has been traced through the forest. By substituting a canal for this portage, as I proposed to the ministry of king Charles IV, the communication between the Rio Negro and Angostura, between the Spanish Orinoco and the Portuguese possessions on the Amazon, would be singularly facilitated.

In this forest we at length obtained precise information

* The Galibis or Caribis (the $r$ has been changed into $l$, as often happens) are of the great stock of the Carib nations. The products useful in commerce and in domestic life have received the same denomination in every part of America which this warlike and commercial people have overrun.
respecting the pretended fossil caoutchouc, called dapicho by the Indians. The old chief Javita led us to the brink of a rivulet which runs into the Tuamin; and showed us that, after digging two or three feet deep, in a marshy soil, this substance was found between the roots of two trees known by the name of the jacio and the curvana. The first is the hevea of Aublet, or siphonia of the modern botanists, known to furnish the caoutchouc of commerce in Cayenne and Grand Para; the second has pinnate leaves, and its juice is milky, but very thin, and almost destitute of viscosity. The dapicho appears to be the result of an extravasation of the sap from the roots. This extravasation takes place more especially when the trees have attained a great age, and the interior of the trunk begins to decay. The bark and alburnum crack; and thus is effected naturally, what the art of man performs for the purpose of collecting the milky juices of the hevea, the castilloa, and the caoutchouc fig-tree. Aublet relates, that the Galibis and the Garipons of Cayenne begin by making a deep incision at the foot of the trunk, so as to penetrate into the wood; soon after they join with this horizontal notch others both perpendicular and oblique, reaching from the top of the trunk nearly to the roots. All these incisions conduct the milky juice towards one point, where the vase of clay is placed, in which the caoutchouc is to be deposited. We saw the Indians of Carichana operate nearly in the same manner.

If, as I suppose, the accumulation and overflowing of the milk in the jacio and the ouroana be a pathological phenomenon, it must sometimes take place at the extremity of the longest roots, for we found masses of dapicho two feet in diameter and four inches thick, eight feet distant from the trunks. Sometimes the Indians dig in vain at the foot of dead trees; at other times the dapicho is found beneath the hevea or jacio still green. The substance is white, corky, fragile, and resembles by its laminated structure and undulating edge, the Boletus ignarius. The dapicho perhaps takes a long time to form ; it is probably a juice thickened by a particular disposition of the vegetable organs, diffused and coagulated in a humid soil secluded from the contact of light; it is caoutchouc in a particular state, I may almost
say an etiolated caoutchouc. The humidity of the soil seems to account for the undulating form of the edges of the dapicho, and its division into layers.

I often observed in Peru, that on pouring slowly the milky juice of the hevea, or the sap of the carica, into a large quantity of water, the coagulum forms undulating outlines. The dapicho is certainly not peculiar to the forest that extends from Javita to Pimichin, although that is the only spot where it has hitherto been found. I have no doubt, that on digging in French Guiana beneath the roots and the old trunks of the hevea, those enormous masses of corky caoutchouc," which I have just described, would from time to time be found. As it is observed in Europe, that at the fall of the leaf the sap is conveyed towards the root, it would be curious to examine whether, within the tropics, the milky juices of the urticem, the euphorbiacem, and the apocynem, descend also at certain seasons. Notwithstanding a great equality of temperature, the trees of the torrid zone follow a cycle of vegetation; they undergo changes periodically returning. The existence of the dapicho is more interesting to physiology than to vegetable chemistry. A yellowish-white caoutchouc is now to be found in the shops, which may be easily distinguished from the dapicho, because it is neither dry like cork, nor friable, but extremely elastic, glossy, and soapy. I lately saw considerable quantities of it in London. This caoutchouc, white, and greasy to the touch, is prepared in the East Indies. It exhales that animal and fetid smell which I have attributed in another place to a mixture of caseum and albumen. $\dagger$ When we reflect on the immense variety

[^291]of plants in the equinoctial regions that are capable of furnishing caoutchouc, it is to be regretted that this substance, so eminently useful, is not found among us at a lower price. Without cultivating trees with a milky sap, a sufficient .quantity of caoutchouc might be collected in the missions of the Orinoco alone for the consumption of civilized Europe.* In the kingdom of New Grenada some successful attempts have been made to make boots and shoes of this substance without a seam. Among the American nations, the Omaguas of the Amazon best understand how to manufacture caoutchouc.

Four days had passed, and our canoe had not yet arrived at the landing-place of the Rio Pimichin. "You want for nothing in my mission," said Father Cereso; "you have plantains and fish; at night you are not stung by mosquitos; and the longer you stay, the better chance you will have of seeing the stars of my country. If your boat be destroyed in the portage, we will give you another; and I shall have had the satisfaction of passing some weeks con gente blanca y de razon."* Notwithstanding our impatience, we listened with interest to the information given us by the worthy missionary. It confirmed all we had already heard of the moral state of the natives of those countries. They live, distributed in hordes of forty or fifty, under a family government; and they recognise a common chief (apoto, sibierene) only at times when they make war against their neighbours. The mistrust of these hordes towards one another is increased by the circumstance that those who live in the nearest neighbourhood speak languages altogether different. In the open plains, in the countries with savannahs, the tribes are fond of choosing their habitations from an affinity of origin, and a resemblance of manners and idioms. On the table-land of Tartary, as in North America, great families of nations have been seen, formed into several columns, extending their migrations across countries thinly-wooded, and easily tra-

[^292]versed. Such were the journeys of the Toltec and Azte.s race in the high plains of Mexico, from the sixth to the eleventh century of our era; such probably was also the movement of nations by which the petty tribes of Canada were grouped together. As the immense country between the equator and the eighth degree of north latitude forms one continuous forest, the hordes were there dispersed by following the branchings of the rivers, and the nature of the land compelled them to become more or less agriculturists. Such is the labyrinth of these rivers, that families settled themselves without knowing what race of men lived nearest the spot. In Spanish Guiana a mountain, or a forest half a league broad, sometimes separates hordes who could not meet in less than two days by navigating rivers. In open countries, or in a state of advanced civilization, communication by rivers contributes powerfully to generalize languages, manners, and political institutions; but in the impenetrable forests of the torrid zone, as in the first rude condition of our species, rivers increase the dismemberment of great nations, favour the transition of dialects into languages that appear to us radically distinct, and keep up national hatred and mistrust. Between the banks of the Caura and the Padamo everything bears the stamp of disunion and weakness. Men avoid, because they do not understand each other; they mutally hate, because they mutually fear.

When we examine attentively this wild part of America, we fancy ourselves transported to those primitive times when the earth was peopled by degrees, and we seem to be present at the birth of human societies. In the old world we see that pastoral life has prepared the hunting nations for agriculture. In the New World we seek in vain these progressive developments of civilization, these intervals of repose, these stages in the life of nations. The luxury of vegetation embarrasses the Indians in the chase; and in their rivers, resembling arms of the sea, the depth of the waters prevents fishing during whole months. Those species of ruminating animals, that constitute the wealth of the nations of the Old World, are wanting in the New. The bison and the musk-ox have never been reduced to a domestic state; the breeding of llamas and guanacos has not created the habits of pastoral life. In the temperate
zone, on the banks of the Missouri, as well as on the tableland of New Mexico, the American is a hunter; but in the torrid zone, in the forests of Guiana, he cultivates cassava, plantains, and sometimes maize. Such is the admirable fertility of nature, that the field of the native is a little spot of land, to clear which requires only setting fire to the brambles; and putting a few seeds or slips into the ground is all the husbandry it demands. If we go back in thought to the most remote ages, in these thick forests we must always figure to ourselves nations deriving the greater part of their nourishment from the earth; but, as this earth produces abundance in a small space, and almost without toil, we may also imagine these nations often changing their dwellings along the banks of the same river. Even now the native of the Orinoco travels with his seeds; and transports his farm (conuco) as the Arab transports his tent, and changes his pasturage. The number of cultivated plants found wild amid the woods, proves the nomad habits of an agricultural people. Can we be surprised, that by these habits they lose almost all the advantages that result in the temperate zone from stationary culture, from the growth of corn, which requires extensive lands and the most assiduous labour?

The nations of the Upper Orinoco, the Atabapo, and the Inirida, like the ancient Germans and the Persians, have no other worship than that of the powers of nature. They call the good principle Cachimana; it is the Manitou, the Great Spirit, that regulates the seasons, and favours the harvests. Along with Cachimans there is an evil principle, Iolokiamo, less powerful, but more artful, and in particular more active. The Indians of the forest, when they occasionally risit the missions, conceive with difficulty the idea of a temple or an image. "These good people," said the missionary, "like only processions in the open air. When I last celebrated the festival of San Antonio, the patron of my village, the Indians of Inirida were present at mass. ' Your God,' said they to me, 'keeps himself' shut up in a house, as if he were old and infirm ; ours is in the forest, in the fields, and on the mountains of Sipapu, whence the rains come.'" Among the more numerous, and on this account less barbarous tribes, religious societien of a singular kind
are formed. Some old Indians pretend to be better instructed than others on points regarding divinity; and to them is confided the famous botuto, of which I have spoken, and which is sounded under the palm-trees that they may bear abundance of fruit. On the banks of the Orinoco there exists no idol, as among all the nations who have remained faithful to the first worship of nature, but the botuto, the sacred trumpet, is an object of veneration. To be initiated into the mysteries of the botuto, it is requisite to be of pure morals, and to have lived single. The initiated are subjected to flagellations, fastings, and other painful exercises. There are but a small number of these sacred trumpets. The most anciently celebrated is that upon a hill near the confluence of the Tomo and the Guainia. It is pretended, that it is heard at once on the banks of the Tuamini, and at the mission of San Miguel de Davipe, a distance of ten leagues. Father Cereso assured us, that the Indians speak of the botuto of Tomo as an object of worship common to many surrounding tribes. Fruit and intoxicating liquors are placed beside the sacred trumpet. Sometimes the Great Spirit himself makes the botuto resound; sometimes he is content to manifest his will through him to whom the keeping of the instrument is entrusted. These juggleries being very ancient (from the fathers of our fathers, say the Indians), we must not be surprised that some unbelievers are already to be found; but they express their disbelief of the mysteries of the botuto only in whispers. Women are not permitted to see this marvellous instrument; and are excluded from all the ceremonies of this worship. If a woman have the misfortune to see the trumpet, she is put to death without mercy. The missionary related to us, that in 1798 he was happy enough to save a young girl, whom a jealous and vindictive lover accused of having followed, from a motive of curiosity, the Indians who sounded the botuto in the plantations. "They would not have murdered her publicly," said father Cesero, "but how was she to be protected from the fanatacism of the natives, in a country where it is so easy to give poison? The young girl told me of her fears, and I sent her to one of the missions of the Lower Orinoco." If the people of Guiana had remained
masters of that vast country; if, without haring been impeded by Christian settlements, they could follow freely the development of their barbarous institutions; the worship of the botuto would no doubt become of some political importance. That mysterious society of the initiated, those guardians of the sacred trumpet, would be transformed into a ruling caste of priests, and the oracle of Tomo would gradually form a link between the bordering nations.

In the evening of the 4th of May we were informed, that an Indian, who had assisted in dragging our bark over the portage of Pimichin, had been stung by a viper. He was a tall strong man, and was brought to the mission in a very alarming state. He had dropped down senseless; and nausea, vertigo, and congestions in the head, had succeeded the fainting. The liana called vejuco de guaco,* which M. Mutis has rendered so celebrated, and which is the most certain remedy for the bite of venomous serpents, is yet unknown in these countries. A number of Indians hastened to the hut of the sick man, and he was cured by an infusion of raiz de mato. We cannot indicate with certainty what plant furnishes this antidote; but I am inclined to think, that the raiz de mato is an apocynea, perhaps the Cerbera thevetia, called by the inhabitants of Cumana lingua de mato or contra-culebra, and which they also use against the bite of serpents. A genus nearly allied to the cerberat is employed in India for the same purpose. It is common enough to find in the same family of plants vegetable poisons, and antidotes against the venom of reptiles. Many tonics and narcotics are antidotes more or less active; and we find these in families very different from each other, in the aristolochim, the apocynem, the gentianæ, the polygalæ,

[^293]the solanex, the compositæ, the malvacex, the drymyrhizem, and, which is still more surprising, even in the palm-trees.

In the hut of the Indian who had been so dangerously bitten by the viper, we found balls two or three inches in diameter, of an earthy and impure salt called chivi, which is prepared with great care by the natives. At Maypures a conferva is burnt, which is left by the Orinoco on the neighbouring rocks, when, after high swellings, it again enters its bed. At Javita a salt is fabricated by the incineration of the spadix and fruit of the palm-tree seje or chimu. This fine palm-tree, which abounds on the banks of the Auvana, near the cataract of Guarinumo, and between Javita and the Canio Pimichin, appears to be a new species of cocoatree. It may be recollected, that the fluid contained in the fruit of the common cocoa-tree is often saline, even when the tree grows far from the sea shore. At Madagascar salt is extracted from the sap of a palm-tree called ciro. Besides the spadix and the fruit of the seje palm, the Indians of Javita lixiviate also the ashes of the famous liana called cupana, which is a new species of the genus paullinia, consequently a very different plant from the cupania of Linnæus. I may here mention, that a missionary seldom travels without being provided with some prepared seeds of the cupana. This preparation requires great care. The Indians scrape the seeds, mix them with flour of cassava, envelope the mass in plantain leaves, and set it to ferment in water, till it acquires a saffron-yellow colour. This yellow paste dried in the sun, and diluted in water, is taken in the morning as a kind of tea. The beverage is bitter and stomachic, but it appeared to me to have a very disagreeable taste.

On the banks of the Niger, and in a great part of the interior of Africa, where salt is extremely rare, it is said of a rich man, "he is so fortunate as to eat salt at his meals." This good fortune is not too common in the interior of Guiana. The whites only, particularly the soldiers of the little fort of San Carlos, know how to procure pure salt, either from the coast of Caracas, or from Chita* by the Rio

[^294]Meta. Here, as throughout America, the Indians eat little meat, and consume scarcely any salt. The chivi of Javita is a mixture of muriate of potash and of soda, of caustic lime, and of several other earthy salts. The Indians dissolve a few particles in water, fill with this solution a leaf of heliconia folded in a conical form, and let drop a little, as from the extremity of a filter, on their food.

On the 5th of May we set off, to follow on foot our canoe, which had at length arrived, by the portage, at the Caño Pimichin. We had to ford a great number of streams ; and these passages require some caution on account of the vipers with which the marshes abound. The Indians pointed out to us on the moist clay the traces of the little black bears so common on the banks of the Temi. They differ at least in size from the Ursus americanus. The missionaries call them 0880 carnicoro, to distinguish them from the osso palmero or tamanoir (Myrmecophaga jubata), and from the osso hormigero, or anteater (tamandua). The flesh of these animals is good to eat; the first two defend themselves by rising on their hind feet. The tamanoir of Buffon is called uaraca by the Indians; it is irascible and courageous, which is extraordinary in an animal without teeth. We found, as we advanced, some vistas in the forest, which appeared to us the richer, as it became more accessible. We here gathered some new species of coffee (the American tribe, with flowers in panicles, forms probably a particular genus); the Galega piscatorum, of which the Indians make use, as they do of jacquinia, and of a composite plant of the Rio Temi, as a kind of barbasco, to intoxicate fish; and finally, the liana, known in those countries by the name of vejuco de mavacure, which yields the famous curare poison. It is neither a phyllanthus, nor a coriaria, as M. Willdenouw conjectured, but, as M: Kunth's researches show, very probably a strychnos. We shall have occasion, farther on, to speak of this venomous substance, which is an important object of trade among the savages.

The trees of the forest of Pimichin have the gigantic height of from eighty to a hundred and twenty feet. In these burning climates the laurineæ and amyris* furnish

- The great white and red cedars of these countries are not the Cedrela odorata, but the Amyris altissima, which is an icica of Aublet.
that fine timber for building, which, on the north-west coast of America, on mountains where the thermometer falls in winter to $20^{\circ}$ cent. below zero, we find in the family of the coniferm. Such, in every zone, and in all the families of American plants, is the prodigious force of vegetation, that, in the latitude of fifty-seven degrees north, on the same isothermal line with St. Petersburgh and the Orkneys, the Pinus canadensis displays trunks one hundred and fifty feet high, and six feet in diameter." Towards night we arrived at a small farm, in the puerto or landing place of Pimichin. We were shown a cross near the road, which marked the spot " where a poor capuchin missionary had been killed by wasps." I state this on the authority of the monks of Javita and the Indians. They talk much in these countries of wasps and venomous ants, but wo saw neither one nor the other of these insects. It is well known that in the torrid zone slight stings often cause fits of fever almost as violent as those that with us accompany severe organic injuries. The death of this poor monk was probably the effect of fatigue and damp, rather than of the venom contained in the stings of wasps, which the Indians dread extremely. We must not confound the wasps of Javita with the melipones bees, called by the Spaniards angelitos (little angels) which covered our faces and hands on the summit of the Silla de Caracas.

The landing place of Pimichin is surrounded by a small plantation of caaco-trees; they are very vigorous, and here, as on the banks of the Atabapo and the Guainia, they are loaded with flowers and fruits at all seasons. They begin to bear from the fourth year; on the coast of Caracas they do not bear till the sixth or eighth year. The soil of these countries is sandy, wherever it is not marshy; but the light lands of the Tuamini and Pimichin are extremely productive $\dagger$. Around the conucos of Pimichin grows, in its wild

* Langsdorf informs us that the inhabitants of Norfolk Sound make boats of a single trunk, fifty feet long, four feet and a half broad, and three high at the sides. They contain thirty persons. These boats remind us of the canoes of the Rio Chagres in the isthmus of Panama, in the torrid zone. The Populus balsamifera also attains an immense height, on the mountains that border Norfolk Sound.
t At Javita, an extent of fifty feet square, planted with Jatropha manihot (yucca) yields in two years, in the worst soil, a harvest of six tortas of cassava : the same extent on a middling soil yielde in fourteen
state, the igua, a tree resembling the Caryocar nuciferum, which is cultivated in Dutch and French Guiana, and which, with the almendron of Mariquita (Caryocar amygdaliferum), the juvia of the Esmeralda (Bertholletia excelsa), and the Geoffreea of the Amazon, yields the finest almonds of all South America. No commercial advantage is here made of the igua; but I saw vessels arrive on the coast of Terra Firma, that came from Demerara laden with the fruit of the Caryocar tomentosum, which is the Pekea tuberculosa of Aublet. These trees reach a hundred feet in height, and present, by the beauty of their corolla, and the multitude of their stamens, a magnificent appearance. I should weary the reader by continuing the enumeration of the vegetable wonders which these vast forests contain. Their variety depends on the coexistence of such a great number of families in a small space of ground, on the stimulating power of light and heat, and on the perfect elaboration of the juices that circulate in these gigantic plants.

We passed the night in a hut lately abandoned by an Indian family, who had left behind them their fishingtackle, pottery, nets made of the petioles of palm-trees; in short, all that composes the household furniture of that careless race of men, little attached to property. A great store of mani (a mixture of the resin of the moronoboea and the Amyris caraña) was accumulated round the house. This is used by the Indians here, as at Cayenne, to pitch their canoes, and fix the bony spines of the ray at the points of their arrows. We found in the same place jars filled with a vegetable milk, which serves as a varnish, and is celebrated in the missions by the name of leche para pintar* (milk for painting). They coat with this viscous juice those articles
months a produce of nine tortas. In an excellent soil, around clumps of mauritia, there is every year from fifty feet square a produce of thirteen or fourteen tortas. A torta weighs three quarters of a pound, and three tortas cost generally in the province of Caracas one silver rial, or oneeighth of a piastre. These statements appear to me to be of some importance, when we wish to compare the nutritive matter which man can obtain from the same extent of soil, by covering it, in different climates, with bread-trees, plantains, jatropha, maize, potatoes, rice, and corn. The tardiness of the harvest of jatropha has, I believe, a beneficial influence on the manners of the natives, by fixing them to the soil, and compelling them to sojourn long on the same spot.
of furniture to which they wish to give a fine white colour. It thickens by the contact of the air, without growing yellow, and it appears singularly glossy. We have already mentioned that the caoutchouc is the oily part, the butter of all vegetable milk. It is, no doubt, a particular modification of caoutchouc that forms this coagulum, this white and glossy skin, that seems as if covered with copal varnish. If different colours could be given to this milky varnish, a very expeditious method would be found of painting and varnishing our carriages by one process. The more we study vegetable chemistry in the torrid zone, the more we shall discover, in remote spots, and half-prepared in the organs of plants, products which we believe belong only to the animal kingdom, or which we obtain by processes which are often tedious and difficult. Already we have found the wax that coats the palm-tree of the Andes of Quindiu, the silk of the palm-tree of Mocoa, the nourishing milk of the palo de vaca, the butter-tree of Africa, and the caseous substances obtained from the almost animalized sap of the Carica papaya. These discoveries will be multiplied, when, as the political state of the world seems now to indicate, European civilization shall flow in a great measure toward the equinoctial regions of the New Continent.

The marshy tract between Javita and the embarcadero of Pimichin is infested with great numbers of vipers. Before we took possession of the deserted hut, the Indians killed two great mapanare serpents.* These grow to four or five feet long. They appeared to me to be the same species as those I saw in the 'Rio Magdalena. This serpent is a beautiful animal, but extremely venomous, white on the belly, and spotted with brown and red on the back. As the inside of the hut was filled with grass, and we were lying on the ground, there being no means of suspending our hammocks, we were not without inquietude during the night. In the morning a large viper was found on lifting the jaguar-skin upon which one of our domestics had slept.

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The Indians say that these reptiles, slow in their movements when they are not pursued, creep near a man because they are fond of heat. In fact, on the banks of the Magdalena a serpent entered the bed of one of our fellow-travellers, and remained there a part of the night, without injuring him. Without wishing to take up the defence of vipers and rattlesnakes, I believe it may be affirmed that, if these venomous animals had such a disposition for offence as is supposed, the human species would certainly not have withstood their numbers in some parts of America; for instance, on the banks of the Orinoco and the humid mountains of Choco.

We embarked on the 8th of May at sunrise, after having carefully examined the bottom of our canoe. It had become thinner, but had received no crack in the portage. We reckoned that it would still bear the voyage of three hundred leagues, which we had yet to perform, in going down the Rio Negro, ascending the Cassiquiare, and redescending the Orinoco as far as Angostura. The Pimichin, which is called a rivulet (caño) is tolerably broad; but small trees that love the water narrow the bed so much that there remains open a channel of only fifteen or twenty toises. Next to the Rio Chagres this river is one of the most celebrated in America for the number of its windings: it is said to have eighty-five, which greatly lengthen it. They often form right angles, and occur every two or three leagues. To determine the difference of longitude between the landing-place and the point where we were to enter the Rio Negro, I took by the compass the course of the Caño Pimichin, and noted the time during which we followed the same direction. The velocity of the current was only $2 \cdot 4$ feet in a second; but our canoe made by rowing 4.6 feet. The embarcadero of the Pimichin appeared to me to be eleven thousand toises west of its mouth, and $0^{\circ} 2^{\prime}$ west of the mission of Javita. This Caño is navigable during the whole year, and has but one raudal, which is somewhat difficult to go up; its banks are low, but rockỳ. After having followed the windings of the Pimichin for four hours and a half we at length entered the Rio Negro.

The morning was cool and beautiful. We had now been confined thirty-six days in a narrow boat, so unsteady that
it would have been overset by any person rising imprudently from his seat, without warning the rowers. We had suffered severely from the sting of insects, but we had withstood the insalubrity of the climate; we had passed without accident the :great number of waterfalls and bars, which impede the navigation of the rivers, and often render it more dangerous than long voyages by sea. After all we had endured, it may be conceived that we felt no little satisfaction in having reached the tributary streams of the Amazon, having passed the isthmus that separates two great systems of rivers, and in being sure of having fulfilled the most important object of our journey, namely, to determine astronomically the course of that arm of the Orinoco which falls into the Rio Negro, and of which the existence has been alternately proved and denied during half a century. In proportion as we draw near to an object we have long had in view, its interest seems to augment. The uninhabited banks of the Cassiquiare, covered with forests, without memorials of times past, then occupied my imagination, as do now the banks of the Euphrates, or the Oxus, celebrated in the annals of civilized nations. In that interior part of the New Continent one may almost accustom one self to regard men as not being essential to the order of nature. The earth is loaded with plants, and nothing impedes their free development. An immense layer of mould manifests the uninterrupted action of organic powers. Crocodiles and boas are masters of the river; the jaguar, the peccary, the dante, and the monkeys traverse the forest without fear and without danger; there they dwell as in an ancient inheritance. This aspect of animated nature, in which man is nothing, has something in it strange and sad. To this we reconcile ourselves with difficulty on the ocean, and amid the sands of Africa; though in scenes where nothing recalls to mind our fields, our woods, and our streams, we are less astonished at the vast solitude through which we pass. Here, in a fertile country, adorned with eternal verdure, we seek in vain the traces of the power of man; we seem to be transported into a world different from that which gave us birth. These impressions are the more powerfiul in proportion as they are of long duration. A soldier, who had spent his whole
life in the missions of the Upper, Orinoco, slept with us on the bank of the river. He was an intelligent man, who, during a calm and serene night, pressed me with questions on the magnitude of the stars, on the inhabitants of the moon, on a thousand subjects of which I was as ignorant as himself. Being unable by my answers to satisfy his curiosity, he said to me in a firm tone of the most positive conviction: " with respect to men, I believe there are no more up there than you would have found if you had gone by land from Javita to Cassiquiare. I think I see in the stars, as here, a plain covered with grass, and a forest (mucho monte) traversed by a river." In citing these words I paint the impression produced by the monotonous aaspect of those solitary regions. May this monotony not be found to extend to the journal of our navigation, and weary the reader accustomed to the description of the scenes and historical memorials of the old continent!

## Chapter XXIII.

The Rio Negro.-Boundaries of Brazil.-The Cassiquiare.-Bifurcation of the Orinoco.

The Rio Negro, compared to the Amazon, the Rio de la Plata, or the Orinoco, is but a river of the second order. Its possession has been for ages of great political importance to the Spanish Government, because it is capable of furnishing a rival power, Portugal, with an easy passage into the missions of Guiana, and thereby disturbing the Capitania general of Caracas in its southern limits. Three hundred years have been spent in vain territorial disputes. According to the difference of times, and the degree of civilization among the natives, resource has been had sometimes to the authority of the Pope, and sometimes the support of astronomy; and the disputants being generally more interested in prolonging than in terminating the struggle, the nautical sciences and the geography of the New Continent, have alone gained by this interminable litigation. When the affairs of Paraguay, and the possession of the colony of Del Sacramento, became of great importanco to the courts
of Madrid and Lisbon, commissioners of the boundaries were sent to the Orinoco, the Amazon, and the Rio Plata.

The little that was known, up to the end of the last century, of the astronomical geography of the interior of the New Continent, was owing to these estimable and laborious men, the French and Spanish academicians, who measured a meridian line at Quito, and to officers who went from Valparaiso to Buenos Ayres to join the expedition of Malaspina. Those persons who know the inaccuracy of the maps of South America, and have seen those uncultivated lands between the Jupura and the Rio Negro, the Madeira and the Ucayale, the Rio Branco and the coasts of Cayenne, which up to our own days have been gravely disputed in Europe, can must not a little surprised at the perseverance with which the possession of a few square leagues is litigated. These disputed grounds are generally separated from the cultivated part of the colonies by deserts, the extent of which is unknown. In the celebrated conferences of Puente de Caya the question was agitated, whether, in fixing the line of demarcation three hundred and seventy Spanish leagues to the west of the Cape Verde Islands, the pope meant that the first meridian should be reckoned from the centre of the island of St. Nicholas, or (as the court of Portugal asserted) from the western extremity of the little island of St. Antonio. In the year 1754, the time of the expedition of Iturriaga and Solano, negociations were entered into respecting the possession of the then desert banks of the Tuamini, and of a marshy tract which we crossed in one evening going from Javita to Caño Pimichin. The Spanish commissioners very recently would have placed the divisional line at the point where the Apoporis falls into the Jupura, while the Portuguese astronomers carried it back as far as Salto Grande.

The Rio Negro and the Jupuro are two tributary streams of the Amazon, and may be compared in length to the Danube. The upper parts belong to the Spaniards, while the lower are occupied by the Portuguese. The Christian settlements are very numerous from Mocoa to the mouth of the Caguan; while on the Lower Jupura the Portuguese have founded only a few villages. On the Rio Negro, on the contrary, the Spaniards have not been able to rival
their neighbours. Steppes and forests nearly desert separate, at a distance of one hundred and sixty leagues, the cultivated part of the coast from the four missions of Marsa, Tomo, Davipe, and San Carlos, which are all that the Spanish Franciscans could establish along the Rio Negro. Among the Portuguese of Brazil the military system, that of presides and capitanes pobladores, has prevailed over the government of the missionaries. Grand Para is no doubt far distant from the nouth of the Rio Negro: but the facility of navigation on the Amazon, which runs like an immense canal in one direction from west to east, has enabled the Portuguese population to extend itself rapidly along the river. The banks of the Lower Marañon, from Vistoza as far as Serpa, as well as those of the Rio Negro from Fort da Bara to San Jose da Maravitanos, are embellished by rich cultivation, and by a great number of large villages and towns.

These local considerations are combined with others, suggested by the moral position of nations. The northwest coast of America furnishes to this day no other stable settlements but Russian and Spanish colonies. Before the inhabitants of the United States, in their progressive movement from east to west, could reach the shore between the latitude $41^{\circ}$ and $50^{\circ}$, which long separated the Spanish monks and the Siberian hunters,* the latter had established themselves south of the Columbia River. Thus in New California the Franciscan missionaries, men estimable for their morals, and their agricultural activity, learnt with astonishment, that Greek priests had arrived in their neighbourhood; and that two nations, who inhabit the eastern and western extremities of Europe, were become neighbours on a coast of America opposite to China. In Guiana circumstances were very different: the Spaniards found on their frontiers those very Portuguese, who, by their language, and their municipal institutions, form with them one of the most noble remains of Roman Europe; but whom mistrust, founded on unequal strength, and too great

[^296]proximity, has converted into an often hostile, and always rival power.

If two nations adjacent to each other in Europe, the Spaniards and the Portuguese, have alike become neighbours in the New Continent, they are indebted for that circumstance to the spirit of enterprise and active courage which both displayed at the period of their military glory and political greatness. The Castilian language 18 now spoken in North and South America throughout an extent

- of more than one thousand nine hundred leagues in length; if, however, we consider South America apart, we there find the Portuguese language spread over a larger space of ground, and spoken by a smaller number of individuals than the Castilian. It would seem as if the bond that so closely connects the fine languages of Camö̈ns and Lope de Vega, had served only to separate two nations, who have become neighbours against their will. National hatred is not modified solely by a diversity of origin, of manners, and of progress in civilization; whenever it is powerful, it must be considered as the effect of geographical situation, and the conflicting interests thence resulting. Nations detest each other the less, in proportion as they are distant; and when, their languages being radically different, they do not even attempt to combine together. Travellers who have passed through New California, the interior provinces of Mexico, and the northern frontiers of Brazil, have been struck by these shades in the moral dispositions of bordering nations.

When I was in the Spanish Rio Negro, the divergent politics of the courts of Lisbon and Madrid had augmented that system of mistrust which, even in calmer times, the commanders of petty neighbouring forts love to encourage. Boats went up from Barcelos as far as the Spanish missions, but the communications were of rare occurrence. A commandant with sixteen or eighteen soldiers wearied 'the garrison' by measures of safety, which were dictated ' by the important state of affairs;' if he were attacked, he hoped to 'surround the enemy.' When we spoke of the indifference with which the Portuguese government doubtless regariled the four little villages founded by the monks of Saint Francisco, on the Upper Guainia, the inhabitants
were hurt by the motives which we alleged with the view to give them confidence. A people who have preserved in vigour, through the revolutions of ages, a national hatred, like occasions of giving it vent. The mind delights in everything impassioned, in the consciousness of an energetic feeling, in the affections, and in rival hatreds that are founded on antiquated prejudices. Whatever constitutes the individuality of nations flows from the mother-country to the most remote colonies; and national antipathies are not effaced where the influence of the same languagesceases. We know, from the interesting narrative of Krusenstern's voyage, that the hatred of two fugitive sailors, one a Frenchman and the other an Englishman, was the cause of a long war between the inhabitants of the Marquesas Islands. On the banks of the Amazon and the Rio Negro, the Indians of the neighbouring Portuguese and Spanish villages detest each other. These poor people speak only the native tongues; they are ignorant of what passes 'on the other bank of the ocean, beyond the great salt-pool;' but the gowns of their missionaries are of a different colour, and this displeases them extremely.

I have stopped to paint the effects of national animosities, which wise statesmen have endeavoured to calm, but have been unable entirely to set at rest. This rivalry has contributed to the imperfection of the geographical knowledge hitherto obtained respecting the tributary rivers of the Amazon. When the communications of the natives are impeded, and one nation is established near the mouth, and another in the upper part of the same river, it is difficult for persons who attempt to construct maps to acquire precise information. The periodical inundations, and still more the portages, by which boats are passed from one stream to another, the sources of which are in the same neighbourhood, have led to erroneous ideas of the bifurcations and branchings of rivers. The Indians of the Portuguese missions, for instance, enter (as I was informed upon the spot) the Spanish Rio Negro on one side by the Rio Guainia and the Rio Tomo; and the Upper Orinoco on the other, by the portages between the Cababuri, the Pacimoni, the Idapa, and the Macava, to gather the aromatic seeds of the puchero laurel beyond the Esmeralda.

The Indians, I repeat, are excellent geographers; they outflank the enemy, notwithstanding the limits traced upon the maps, in spite of the forts and the estacamentos; and when the missionaries see them arrive from such distances, and in different seasons, they begin to frame hypotheses of supposed communications of rivers. Each party has an interest in concealing what it knows with certainty; and that love of the mysterious, so general among the ignorant, contributes to perpetuate the doubt. It may also be observed that the various Indian nations, who frequent this labyrinth of rivers, give them names entirely different; and that these names are disguised and lengthened by terminations that signify 'water,' 'great water,' and ' current.' How often have I been perplexed by the necessity of settling the synonymes of rivers, when I have sent for the most intelligent natives, to interrogate them, through an interpreter, respecting the number of tributary streams, the sources of the rivers, and the portages. Three or four languages being spoken in the same mission, it is difficult to make the witnesses agree. Our maps are loaded with names arbitrarily shortened or perverted. To examine how far they may be accurate, we must be guided by the geographical situation of the confluent rivers, I might almost say by a certain etymological tact. The Rio Uaupe, or Uapes of the Portuguese maps, is the Guapue of the Spanish maps, and the Ucayari of the natives. The Anava of the old geographers is the Anauahu of Arrowsmith, and the Uanauhau or Guanauhu of the Indians. The desire of leaving no void in the maps, in order to give them an appearance of accuracy, has caused rivers to be created, to which names have been applied that have not been recognized as synonymous. It is only lately that travellers in America, in Persia, and in the Indies, have felt the importance of being correct in the denomination of places. When we read the travels of Sir Walter Raleigh, it is difficult indeed to recognise in the 'lake of Mrecabo', the laguna of Maracaybo, and in the 'Marquis Paraco' the name of Pizarro, the destroyer of the empire of the Incas.

The great tributary streams of the Amazon are designated by the missionaries by different names in their upper
and lower course. The Iza is called, higher up, Patumayo; the Jupura towards its source bears the name of Caqueta. The researches made in the missions of the Andaquies on the real origin of the Rio Negro have been the more fruitless because the Indian name of the river was unknown. I heard it called Guainia at Javita, Maroa, and San Carlos. Southey, in his history of Brazil, says expressly that the Rio Negro, in the lower part of its course, is called Guiani, or Curana, by the natives; in the upper part, Ueneya. It is the word Gueneya, instead of Guainia; for the Indians of those countries say indifferently Guaranacua or Ouaranacua, Guarapo or Uarapo.

The sources of the Rio Negro have long been an object of contention among geograpers. The interest we feel in this question is not merely that which attaches to the origin of all great rivers, but is connected with a crowd of other questions, that comprehend the supposed bifurcations of the Caqueta, the communications between the Rio Negro and the Orinoco, and the local fable of El Dorado, formerly called Enim, or the empire of the Grand Paytiti. When we study with care the ancient maps of these countries, and the history of their geographical errors, we see how by degrees the fable of El Dorado has been transported towards the west with the sources of the Orinoco. It was at first fixed on the eastern declivity of the Andes, to the south-west of the Rio Negro. The valiant Philip de Urre sought for the great city of Manoa by traversing the Guaviare. Even now the Indians of San Jose de Maravitanos relate that, "on sailing to the north-east for fifteen days, on the Guape or Uaupe, you rench a famous laguna de oro, surrounded by mountains, and so large that the opposite shore cannot be discerned. A ferocious nation, the Guanes, do not permit the collecting of the gold of a sandy plain that surrounds the lake. Father Acunha places the lake Manoa, or Yenefiti, between the Jupura and the Rio Negro. Some Manoa Indians brought Father Fritz, in 1687, several slips of beaten gold. This nation, the name of which is still known on the banks of the Urarira, between Lamalongo and Moreira, dwelt on the Yurubesh. La Condamine is right in saying that this Mesopotamia, between the Caqueta, the Rio Negro, the Yurubesh, and
the Iquiare, was the first scene of El Dorado. But where shall we find the names of Yurubesh and Iquiare, given by the Fathers Acunha and Fritz? I think I recognise them in the rivers Urubaxi and Iguari,* on some manuscript Portuguese maps which I possess. I have long and assiduously studied the geography of South America, north of the Amazon, from ancient maps and unpublished materials. Desirous that my work should preserve the character of a scientific performance, I ought not to hesitate about treating of subjects on which I flatter myself that I can throw some light; namely, on the questions respecting the sources of the Rio Negro and the Orinoco, the communication between these rivers and the Amazon, and the problem of the auriferous soil, which has cost the inhabitants of the New World so much suffering and so much blood.

In the distribution of the waters circulating on the surface of the globe, as well as in the structure of organic bodies, nature has pursued a much less complicated plan than has been believed by those who have suffered themselves to be guided by vague conceptions and a taste for the marvelloús. We find, too, that all anomalies, all the exceptions to the laws of hydrography, which the interior of America displays, are merely apparent; that the course of running waters furnishes phenomena equally extraordinary in the old world, but that these phenomena, from their littleness, have less struck the imagination of travellers. When immense rivers may be considered as composed of several parallel furrows of unequal depth; when these rivers are not enclosed in valleys; and when the interior of the great continent is as flat as the shores of the sea with us; the ramifications, the bifurcations, and the interlacings in the form of net-work, must be infinitely multipied. From what we know of the equilibrium of the seas, I cannot think that the New World issued from the waters later than the Old, and that organic life is there younger, or more recent; but without admitting oppositions between the

* It may be written Urubaji. The $j$ and the $x$ were the same as the German $c h$ to Father Fritz. The Urubaxi, or Hyurubaxi (Yurabesh), falls into the Rio Negro near Santa Isabella; the Iguari (Iquiare ?) runs into the Issana, which is also a tributary of the Rio Negro.
two hemispheres of the same planet, we may conceive that in the hemisphere most abundant in waters the different systems of rivers required more time to separate themselves from one another, and establish their complete independence. The deposits of mud, which are formed wherever the running waters lose somewhat of their swiftness, contribute, no doubt, to raise the beds of the great confluent streams, and augment their inundations; but at length these deposits entirely obstruct the branches of the rivers and the narrow channels that connect the neighbouring streams. The substances washed down by rain-waters form by their accumulation new bars, isthmuses of deposited earth, and points of division that did not before exist. It hence results that these natural channels of communication are by degrees divided into two tributary streams, and from the effect of a transverse rising, acquire two opposite slopes; a part of their waters is turned back towards the principal recipient, and a buttress rises between the two parallel basins, which occasions all traces of their ancient communication to disappear. From this period the bifurcations no longer connect different systems of rivers; and, where they continue to take place at the time of great inundations, we see that the waters diverge from the principal recipient only to enter it again after a longer or shorter circuit. The limits, which at first appeared vague and uncertain, begin to be fixed; and in the lapse of ages, from the action of whatever is moveable on the surface of the globe, from that of the waters, the deposits, and the sands, the basins of rivers separate, as great lakes are subdivided, and as inland seas lose their ancient communications.*

The certainty acquired by geographers since the sixteenth century, of the existence of several bifurcations, and the mutual dependence of various systems of rivers in South America, have led them to admit an intimate connection

[^297]between the five great tributary streams of the Ornoco and the Amazon; the Guaviare, the Inirida, the Rio Negro, the Caqueta or Hyapura, and the Putumayo or Iza.

The Meta, the Guaviare, the Caqueta, and the Putumayo, are the only great rivers that rise immediately from the eastern declivity of the Andes of Santa Fé, Popayan, and Pasto. The Vichada, the Zama, the Inirida, the Rio Negro, the Uaupe, and the Apoporis, which are marked in our maps as extending westward as far as the mountains, take rise at a great distance from them, either in the savannahs between the Meta and the Guaviare, or in the mountainous country which, according to the information given me by the natives, begins at four or five days' journey westward of the missions of Javita and Maroa, and extends through the Sierra Tuhuny, beyond the Xiè, towards the banks of the Issana.

It is remarkable that this ridge of the Cordilleras, which contains the sources of so many majestic rivers, (the Meta, the Guaviare, the Caqueta, and the Putumayo,) is as little covered with snow as the mountains of Abyssinia from which flow the waters of the Blue Nile; but, on the contrary, on going up the tributary streams which furrow the plains, a volcano is found still in activity, before you reach the Cordillera of the Andes. This phenomenon was discovered by the Franciscan monks, who go down from Ceja by the Rio Fragua to Caqueta. A solitary hill, emitting smoke night and day, is found on the north-east of the mission of Santa Rosa, and west of the Puerto del Pescado. This is the effect of a lateral action of the volcanos of Popayan and Pasto; as Guacamayo and Sangay, situated also at the foot of the eastern declivity of the Andes, are the effect of a lateral action produced by the system of the volcanos of Quito. After having closely inspected the banks of the Orinoco and the Rio Negro, where the granite everywhere pierces the soil; when we reflect on the total absence of volcanos in Brazil, Guiana, on the coast of Venezuela, and perhaps in all that part of the continent lying eastward of the Andes; we contemplate with interest the three burning volcanos situated near the sources of the Caqueta, the Napo, and the Rio de Macas or Morona.

The little group of mountains with which we became ac-
quainted at the sources of the Guainia, is remarkable from its being isolated in the plain that extends to the south-west of the Orinoco. Its situation with regard to longitude might lead to the belief that it stretches into a ridge, which forms first the strait (angostura) of the Guaviare, and then the great cataracts (saltos, cachoèiras) of the Uaupe and the Jupura. Does this ground, composed probably of primitive rocks, like that which I examined more to the east, contain disseminated gold? Are there any gold-washings more to the south, toward the Uaupe, on the Iquare (Iguiari, Iguari), and on the Yurubesh (Yurubach, Urubaxi)? It was there that Philip von Huten first sought El Dorado, and with a handful of men fought the battle of Omaguas, so celebrated in the sixteenth century. In separating what is fabulous from the narratives of the Conquistadores, we cannot fail to recognize in the names preserved on the same spots a certain basis of historic truth. We follow the expedition of Huten beyond the Guariare and the Caqeta; we find in the Guaypes, governed by the cacique of Macatoa, the inhabitants of the river of Uaupe, which also bears the name of Guape, or Guapue; we call to mind, that Father Acunha calls the Iquiari (Quiquiare) 'a gold river'; and that fifty years later Father Fritz, a missionary of great veracity, received, in the mission of Yurimaguas, the Manaos (Manoas), adorned with plates of beaten gold, coming from the country between the Uaupe and the Caqueta, or Jupura. The rivers that rise on the eastern declivity of the Andes (for instance the Napo) carry along with them a great deal of gold, even when their sources are found in trachytic soils. Why may there not be an alluvial auriferous soil to the east of the Cordilleras, as there is to the west, in the Sonoro, at Choco, and at Barbacoas? I am far from wishing to exaggerate the riches of this soil; but I do not think myself authorized to deny the existence of precious metals in the primitive mountains of Guiana, merely because in our journey through that country we saw no metallic veins. It is somewhat remarkable that the natives of the Orinoco have a name in their languages for gold (carucuru in Caribbee, caricuri in Tamanac, cavitta in Maypure), while the word they use to denote silver,
prata, is manifestly borrowed from the Spanish.* The notions collected by Acunha, Father Fritz, and La Condamine, on the gold-washings south and north of the river Uaupe, agree with what I learnt of the auriferous soil of those countries. However great we may suppose the communications that took place between the nations of the Orinoco before the arrival of Europeans, they certainly did not draw their gold from the eastern declivity of the Cordilleras. This declivity is poor in mines, particularly in mines anciently worked; it is almost entirely composed of volcanic rocks in the provinces of Popayan, Pasto, and Quito. The gold of Guiana probably came from the country east of the Andes. In our days a lump of gold has been found in a ravine near the mission of Encaramada, and we must not be surprised if, since Europeans settled in these wild spots, we hear less of the plates of gold, gold-dust, and amulets of jade-stone, which could heretofore be obtained from the Caribs and other wandering nations by barter. The precious metals, never very abundant on the banks of the Orinoco, the Rio Negro, and the Amazon, disappeared almost entirely when the system of the missions caused the distant communications between the natives to cease.

The banks of the Upper Guainia in general abound much less in fishing-birds than those of Cassiquiare, the Meta, and the Auraca, where ornithologists would find sufficient to enrich immensely the collections of Europe. This scarcity of animals arises, no doubt, from the want of shoals and flat shores, as well as from the quality of the black waters, which (on account of their very purity) furnish less aliment to aquatic insects and fish. However, the Indians of these countries, during two periods of the year, feed on birds of passage, which repose in their long

* The Parecas say, instead of prata, rata. It is the Castilian word plata ill-pronounced. Near the Yurubesh there is another inconsiderable tributary stream of the Rio Negro, the Curicur-iari. It is easy to recognize in this name the Caribbee word carucur, gold. The Caribs extended their incursions from the mouth of the Orinoco south-west toward the Rio Negro; and it was this restless people who carried the fable of El Dorado, by the same way, but in an opposite direction (from south-west to north-east), from the Mesopotamia between the Rio Negro and the Jupura to the sources of the Rio Branco.
migrations on the waters of the Rio Negro. When the Orinoco begins to swell* after the vernal equinox, an innumerable quantity of ducks (patos careteros) remove from the eighth to the thrrd degree of north latitude, to the first and fourth degree of south latitude, towards the south-south-east. These animals then abandon the valley of the Orinoco, no doubt because the increasing depth of waters, and the inundations of the shores, prevent them from catching fish, insects, and aquatic worms. They are killed by thousands in their passage across the Rio Negro. When they go towards the equator they are very fat and savoury ; but in the month of September, when the Orinoco decreases and returns into its bed, the ducks, warned either by the voices of the most experienced birds of passage, or by that internal feeling which, not knowing how to define, we call instinct, return from the Amazon and the Rio Branco towards the north. At this period they are too lean to tempt the appetite of the Indians of the Rio Negro, and escape pursuit more easily from being accompanied by a species of herons (gavanes) which are excellent eating. Thus the Indians eat ducks in March, and herons in September. We could not learn what becomes of the gavanes during the swellings of the Orinoco, and why they do not accompany the patos careteros in their migration from the Orinoco to the Rio Branco. These regular migrations of birds from one part of the tropics towards another, in a zone which is during the whole year of the same temperature, are very extraordinary phenomena. The southern coasts of the West India Islands receive also every year, at the period of the inundations of the great rivers of Terra Firma, numerous flights of the fishing-birds of the Orinoco, and of its tributary streams. We must presume that the variations of drought and humidity in the equinoctial zone have the same influence as the great changes of temperature in our climates, on the habits of animals. The heat of summer, and the pursuit of insects, cali the hum-ming-birds into the northern parts of the United States, and into Canada as far as the parallels of Paris and Berlin : in

[^298]the same manner a greater facility for fishing draws the webfooted and long-legged birds from the north to the south, from the Orinoco towards the Amazon. Nothing is more marvellous, and nothing is yet known less clearly in a geographical point of view, than the direction, extent, and term of the migrations of birds.

After having entered the Rio Negro by the Pimichin, and passed the small cataract at the confluence of the two rivers, we discovered, at the distance of a quarter of a league, the mission of Maroa. This village, containing one hundred and fifty Indians, presented an appearance of ease and prosperity. We purchased some fine specimens of the toucan alive; a courageous bird, the intelligence of which is developed like that of our domestic ravens. We passed on the right, above Maroa, first the mouth of the Aquio,* then that of the Tomo. $\dagger$ On the banks of the latter river dwell the Cheruvichahenas, some families of whom I have seen at San Francisco Solang. The Tomo lies near the Rio Guaicia (Xiè), and the mission of Tomo receives by that way fugitive Indians from the Lower Guainia. We did not enter the mission, but Father Zea related to us with a smile, that the Indians of Tomo and Maroa had been one day in full insurrection, because an attempt was made to force them to dance the famous "dance of the devils." The missionary had taken a fancy to have the ceremonies by which the piaches (who are at once priests, physicians, and conjurors) evoke the evil spirit Iolokiamo, represented in a burlesque manner. He thought that the "dance of the devils" would be an excellent means of proving to the neophytes that Iolokiamo had no longer any power over them. Some young Indians, confiding in the promises of the missionary, consented to act the devils, and were already decorated with black and yellow plumes, and jaguar-skins with long sweeping tails. The place where the church stands was surrounded by the soldiers who are distributed in the missions, in order to add more effect to the counsels of the monks; and those Indians who were not entirely satisfied with respect to the consequences of the dance, and the impotency of the evil spirit, were brought to

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the festivity. The oldest and most timid of the Indians, however, imbued all the rest with a superstitious dread; all resolved to flee al monte, and the missionary adjourned his project of turning into derision the demon of the natives. What extravagant ideas may sometimes enter the imagination of an idle monk, who passes his life in the forests, far from everything that can recall human civilization to his mind. The violence with which the attempt was made to execute in public at Tomo the mysterious dance of the devils is the more strange, as all the books written by the missionaries relate the efforts they have used to prevent the funcreal dances, the dances of the sacred trumpet, and that ancient dance of serpents, the Queti, in which these wily animals are represented as issuing from the forests, and coming to drink with the men in order to deceive them, and carry off the women.

After two hours' navigation from the mouth of the Tomo we arrived at the little mission of San Miguel de Davipe, founded in 1775, not by monks, but by a lieutenant of militia, Don Francisco Bobadilla. The missionary of the place, Father Morillo, with whom we spent some hours, received us with great hospitality. He even offered us Madeira wine, but, as an object of luxury, we should have preferred wheaten bread. The want of bread becomes more sensibly felt in length of time than that of a strong liquor. The Portuguese of the Amazon carry small quantities of Madeira wine, from time to time, to the Rio Negro; and the word madera signifying wood in the Castilian language, the monks, who are not much versed in the study of geography, had a scruple of celebrating mass with Madeira wine, which they took for a fermented liquor extracted from the trunk of some tree, like palm-wine; and requested the guardian of the missions to decide, whether the vino de madera were wine from grapes, or the juice of a tree. At the beginning of the conquest, the question was agitated, whether it were allowable for the priests, in celebrating mass, to use any fermented liquor analogous to grape-wine. The question, as might have been foreseen, was decided in the negative.

At Davipe we bought some provisions, among which were fowls and a pig. This purchase greatly interested our Indians, who had been a long while deprived of meat. They
pressed us to depart, in order to reach the island of Dapa, where the pig was to be killed and roasted during the night. We had scarcely time to examine in the convent (convento) the great stores of mani resin, and cordage of the chiquichiqui palm, which deserves to be more known in Europe. This cordage is extremely light; it floats upon the water, and is more durable in the navigation of rivers than ropes of hemp. It must be preserved at sea by being often wetted, and little exposed to the heat of the tropical sun. Don Antonio Santos, celebrated in the country for his journey in search of lake Parima, taught the Indians of the Spanish Rio Negro to make use of the petioles of the chiquichiqui, a palm-tree with pinnate leaves, of which we saw neither the flowers nor the fruit. This officer is the only white man who ever came from Angostura to Grand Para, passing by land from the sources of the Rio Carony to those of the Rio Branco. He had studied the mode of fabricating ropes from the chiquichiqui in the Portuguese colonies; and, on his return from the Amazon, he introduced this branch of industry into the missions of Guiana. It were to be wished that extensive rope-walks could be established on the banks of the Rio Negro and the Cassiquiare, in order to make these cables an article of trade with Europe. A small quantity is already exported from Angostura to the West Indies; and it costs from fifty to sixty per cent less than cordage of hemp. Young palm-trees only being employed, they must be planted and carefully cultivated.
A little above the mission of Davipe, the Rio Negro receives a branch of the Cassiquiare, the existence of which is a very remarkable phenomenon in the history of the branchings of rivers. This branch issues from the Cassiquiare, north of Vasiva, bearing the name of the Itinivini; and, after flowing for the length of twenty-five leagues through a flat and almost uninhabited country, it falls into the Rio Negro under the name of the Rio Conorichite. It appeared to me to be more than one hundred and twenty toises broad near its mouth. Although the current of the Conorochite is very rapid, this natural canal abridges by three days the passage from Davipe to Esmeralda. We cannot be surprised at a double communication between the Cassiquiare
and the Rio Negro, when we recollect that so many of the rivers of America form, as it were, deltas at their confluence with other rivers. Thus the Rio Branco and the Rio Jupura enter by a great number of branches into the Rio Negro and the Amazon. At the confluence of the Jupura there is a much more extraordinary phenomenon. Before this river joins the Amazon, the latter, which is the principal recipient, sends off three branches called Uaranapu, Manhama, and Avateparana, to the Jupura, which is but a tributary stream. The Portuguese astronomer, Ribeiro, has proved this important fact. The Amazon gives waters to the Jupura itself, before it receives that tributary stream.

The Rio Conorichite, or Itinivini, formerly facilitated the trade in slaves carried on by the Portuguese in the Spanish territory. The slave-traders went up by the Cassiquiare and the Caño Meë to Conorichite; and thence dragged their canoes by a portage to the rochelas of Manuteso, in order to enter the Atabapo. This abominable trade lasted till about the year 1756; when the expedition of Solano, and the establishment of the missions on the banks of the Rio Negro, put an end to it. Old laws of Charles V and Philip III* had forbidden under the most severe penalties (such as the being rendered incapable of civil employment, and a fine of two thousand piastres), "the conversion of the natives to the faith by violent means, and sending armed men against them;" but notwithstanding these wise and humane laws, the Rio Negro, in the middle of the last century, was no further interesting in European politics, than as it facilitated the entradas, or hostile incursions, and favoured the purchase of slaves. The Caribs, a trading and warlike people, received from the Portuguese and the Dutch, knives, fish-hooks, small mirrors, and all sorts of glass beads. They excited the Indian chiefs to make war against each other, bought their prisoners, and carried off, themselves, by stratagem or force, all whom they found in their way. These incursions of the Caribs comprehended an immense extent of land; they went from the banks of the Essequibo and the Carony, by the Rupunuri and the Paraguamuzi on one side, directly south towards the Rio Branco; and on the other, to the south-west, following the

[^300]portages between the Rio Paragua, the Caura, and the Ventuario. The Caribs, when they arrived amid the numerous tribes of the Upper Orinoco, divided themselves into several bands, in order to reach, by the Cassiquiare, the Cababury, the Itinivini, and the Atabapo, on a great many points at once, the banks of the Guiainia or Rio Negro, and carry on the slave-trade with the Portuguese. Thus the unhappy natives, before they came into immediate contact with the Europeans, suffered from their proximity. The same causes produce everywhere the same effects. The barbarous trade which civilized nations have carried on, and still partially continue, on the coast of Africa, extends its fatal influence even to regions where the existence of white men is unknown.
Having quitted the mouth of the Conorichite and the mission of Davipe, we reached at sunset the island of Dapa, 'lying in the middle of the river, and very picturesquely situated. We were astonished to find on this spot some cultivated ground, and on the top of a small hill an Indian hut. Four natives were seated round a fire of brushwood, and they were eating a sort of white paste with black spots, which much excited our curiosity. These black spots proved to be vachacos, large ants, the hinder parts of which resemble a lump of grease. They had been dried, and blackened by smoke. We saw several bags of them suspended above the fire. These good people paid but little attention to us; yet there were more than fourteen persons in this confined hut, lying naked in hammocks hung one above another. When Father Zea arrived, he was received with great demonstrations of joy. The military are in greater numbers on the banks of the Rio Negro than on those of the Orinoco, owing to the necessity of guarding the frontiers; and wherever soldiers and monks dispute for power over the Indians, the latter are most attached to the monks. Two young women came down from their hammocks, to prepare for us cakes of cassava. In answer to some enquiries which we put to them through an interpreter, they answered that cassava grew poorly on the island, but that it was a good land for ants, and food was not wanting. In fact, these vachacos furnish subsistence ta the Indians of the Rio Negro and the Guainia. They
do not eat the ants as a luxury, but because, according to the expression of the missionaries, the fat of ants (the white part of the abdomen) is a very substantial food. When the cakes of cassava were prepared, Father Zea, whose fever seemed rather to sharpen than to enfeeble his appetite, ordered a little bag to be brought to him filled with smoked vachacos. He mixed these bruised insects with flour of cassava, which he pressed us to taste. It somewhat resembled rancid butter mixed with crumb of bread. The cassava had not an acid taste, but some remains of European prejudices prevented our joining in the praises bestowed by the good missionary on what he called ' an excellent ant paste.'

The violence of the rain obliged us to sleep in this crowded hut. The Indians slept only from eight till two in the morning; the rest of the time they employed in conversing in their hammocks, and preparing their bitter beverage of cupana. They threw fresh fuel on the fire, and complained of cold, although the temperature of the air was at $21^{\circ}$. This custom of being awake, and even on foot, four or five hours before sunrise, is general among the Indians of Guiana. When, in the entradas, an attempt is made to surprise the natives, the hours chosen are those of the first sleep, from nine till midnight.

We left the island of Dapa long before daybreak; and notwithstanding the rapidity of the current, and the activity of our rowers, our passage to the fort of San Carlos del Rio Negro occupied twelve hours. We passed, on the left, the mouth of the Cassiquiare, and, on the right, the small island of Cumarai. The fort is believed in the country to be on the equatorial line; but, according to the observations which I made at the rocks of Culimacari, it is in $1^{\circ} 54^{\prime} 11^{\prime \prime}$.

We lodged at San Carlos with the commander of the fort, a lieutenant of militia. From a gallery in the upper part of the house we enjoyed a delightful view of three islands of great length, and covered with thick vegetation. The river runs in a straight line from north to south, as if its bed had been dug by the hand of man. The sky being constantly cloudy gives these countries a solemn and gloomy character. We found in the village a few juviatrees, which furnish the triangular nuts called in Europe
the almonds of the Amazon, or Brazil-nuts. We have made it known by the name of Bertholletia excelsa. The trees attain after eight years' growth the height of thirty feet.

The military establishment of this frontier consisted of seventeen soldiers, ten of whom were detached for the security of the neighbouring missions. Owing to the extreme humidity of the air there are not four muskets in a condition to be fired. The Portuguese have from twenty-five to thirty men, better clothed and armed, at the little fort of San Jose de Maravitanos. We found in the mission of San Carlos but one garita,* a square house, constructed with unbaked bricks, and containing six field-pieces. The little fort, or, as they think proper to call it here, the Oastillo de San Felipe, is situated opposite San Carlos, on the western bank of the Rio Negro.

The banks of the Upper Guainia will be more productive when, by the destruction of the forests, the excessive humidity of the air and the soil shall be diminished. In their present state of culture maize scarcely grows, and the tobacco, which is of the finest quality, and much celebrated on the coast of Caracas, is well cultivated only on spots amid old ruins, remains of the huts of the pueblo viejo (old town). Indigo grows wild near the villages of Maroa, Davipe, and Tomo. Under a different system from that which we found existing in these countries, the Rio Negro will produce indigo, coffee, cacao, maize, and rice, in abundance.

The passage from the mouth of the Rio Negro to Grand Para occupying only twenty or twenty-five days, it would not have taken us much more time to have gone down the Amazon as far as the coast of Brazil, than to return by the Cassiquiare and the Orinoco to the northern coast of Caracas. We were informed at San Carlos that, on account of political circumstances, it was difficult at that moment to pass from the Spanish to the Portuguese settlements; but we did not know till after our return to Europe the extent of the danger to which we should have been exposed in proceeding as far as Barcellos. It was known at Brazil, possibly through the medium of the newspapers, that I was

* This word literally signifies a sentry-box ; but it is here employed in the sense of store-house or arsenal.
going to visit the missions of the Rio Negro, and examine the natural canal which unites two great systems of rivers. In those desert forests instruments had been seen only in the hands of the commissioners of the boundaries; and at that time the subaltern agents of the Portuguese government could not conceive how a man of sense could expose himself to the fatigues of a long journey, " to measure lands that did not belong to him." Orders had been issued to seize my person, my instruments, and, above all, those registers of astronomical observations, so dangerous to the safety of states. We were to be conducted by way of the Amazon to Grand Para, and thence sent back to Lisbon. But fortunately for me, the government at Lisbon, on being informed of the zeal of 1ts subaltern agents, instantly gave orders that I should not be disturbed in my operations; but that on the contrary they should be encouraged, if I traversed any.part of the Portuguese possessions.

In going down the Guainia, or Rio Negro, you pass on the right the Caño Maliapo, and on the left the Caños Dariba and Eny. At five leagues distance, nearly in $1^{\circ} 38^{\prime}$ of north latitude, is the island of San Josef. A little below that island, in a spot where there are a great number of orange-trees now growing wild, the teaveller is shown a small rock, two hundred feet high, with a cavern called by the missionaries the Glorieta de Cocuy. This summerhouse (for such is the signification of the word glorieta in Spanish) recalls remembrances that are not the most agreeable. It was here that Cocuy, the chief of the Manitivitanos,* had his harem of women, and where he devoured the finest and fattest. The tradition of the harem and the orgies of Cocuy is more current in the Lower Orinoco than on the banks of the Guainia. At San Carlos the very idea that the chief of the Manitivitanos could be guilty of cannibalism is indignantly rejected.

The Portuguese government has established many settlements even in this remote part of Brazil. Below the Glorieta, in the Portuguese territory, there are eleven villages in an extent of twenty-five leagues. I know of

[^301]nineteen more as far as the mouth of the Rio Negro, beside the six towns of Thomare, Moreira (near the Rio Demenene, or Uaraca, where dwelt anciently the Guiana Indians), Barcellos, San Miguel del Rio Branco, near the river of the same name (so well known in the fictions of El Dorado), Moura, and Villa do Rio Negro. The banks of this tributary stream of the Amazon alone are consequently ten times more thickly peopled than all the shores of the Upper and Lower Orinoco, the Cassiquiare, the Atabapo, and the Spanish Rio Negro.

Among the tributary streams which the Rio Negro receives from the north, three are particularly deserving of attention, because on account of their branchings, their portages, and the situation of their sources, they are connected with the often-discussed problem of the origin of the Orinoco. The most southern of these tributary streams are the Rio Branco,* which was long believed to issue conjointly with the Orinoce from lake Parime, and the Rio Padaviri, which communicates by a portage with the Mavaca, and consequently with the Upper Orinoco, to the east of the mission of Esmeralda. We shall have occasion to speak of the Rio Branco and the Padaviri, when we arrive in that mission; it suffices here to pause at the third tributary stream of the Rio Negro, the Cababury, the interbranchings of which with the Cassiquiare are alike important in their connexion with hydrography, and with the trade in sarsaparilla.

The lofty mountains of the Parime, which border the northern bank of the Orinoco in the upper part of its course above Esmeralda, send off a chain towards the south, of which the Cerro de Unturan forms one of the principal summits. This mountainous country, of small extent but rich in vegetable productions, above all, in the mavacure liana, employed in preparing the wourali poison, in almond* The Portuguese name, Rio Branco, signifies White River. Rio Parime is a Caribbean name, signifying Great Water. These names having also been applied to different tributary streams, have caused many errors in geography. The great Rio Branco, or Parime, often mentioned in this work, is formed by the Urariquera and the Tacuta, and flows, between Carvoeyro and Villa de Moura, into the Rio Negro. It is the Quecuene of the natives; and forms at its confluence with the Rio Negro a very narrow delta, between the principal trunk and the Amayauhau, which is a little branch more to the west.
trees (the juvia, or Bertholletia excelsa), in aromatic pucheries, and in wild caca-trees, forms a point of division between the waters that flow to the Orinoco, the Cassiquiare, and the Rio Negro. The tributary streams on the north, or those of the Orinoco, are the Mavaca and the Daracapo; those on the west, or of the Cassiquiare, are the Idapa and the Pacimoni; and those on the south, or of the Rio Negro, are the Padaviri and the Cababuri. The latter is divided near its source into two branches, the westernmost of which is known by the name of Baria. The Indians of the mission of San Francisco Solano gave us the most minute description of its course. It affords the very rare example of a branch by which an inferior tributary stream, instead of receiving the waters of the superior stream, sends to it a part of its own waters in a direction opposite to that of the principal recipient.
The Cababiuri runs into the Rio Negro near the mission of Nossa Senhora das Caldas; but the rivers Ya and Dimity, which are higher tributary streams, communicate also with the Cababuri ; so that, from the little fort of San Gabriel de Cachòeiras as far as San Antonio de Castanheira the Indians of the Portuguese possessions can enter the territory of the Spanish missions by the Baria and the Pacimoni.

The chief object of these incursions is the collection of sarsaparilla and the aromatic seeds of the puchery-laurel (Laurus pichurim). The sarsaparilla of these countries is celebrated at Grand Para, Angostura, Cumana, Nueva Barcelona, and in other parts of Terra Firma, by the name of zarza del Rio Negro. It is much preferred to the zarza of the province of Caracas, or of the mountains of Merida; it is dried with great care, and exposed purposely to smoke, in order that it may become blacker. This liana grows in profusion on the humid declivities of the mountains of Unturan and Achivaquery. Decandolle is right in suspecting that different species of smilax are gathered under the name of sarsaparilla. We found twelve new species, among which the Smilax siphylitica of the Cassiquaire, and the Smilax officinalis of the river Magdalena, are most esteemed on account of their diuretic properties. The quantity of sarsaparilla employed in the Spanish colonies as a domestic
medicine is very considerable. We see by the works of Clusius, that at the beginning of the Conquista, Europe obtained this salutary medicament from the Mexican coast of Honduras and the port of Guayaquil. The trade in zarza is now more active in those ports which have interior communications with the Orinoco, the Rio Negro, and the Amazon.

The trials made in several botanical gardens of Europe prove that the Smilax glauca of Virginia, which it is pretended is the S. sarsaparilla of Linnæus, may be cultivated in the open air, wherever the mean winter temperature rises above six or seven degrees of the centigrade thermometer*; but those species that possess the most active virtues belong exclusively to the torrid zone, and require a much higher degree of heat. In reading the works of Clusius, it can scarcely be conceived why our writers on the Materia Medica persist in considering a plant of the United States as the most ancient type of the officinal species of the genus smilax.

We found in the possession of the Indians of the Rio Negro some of those green stones, known by the name of "Amazon stones," because the natives pretend, according to an ancient tradition, that they come from the country " of the women without husbands (Cougnantainsecouima), or women living alone (Aikeambenano $\dagger$ )." We were told at San Carlos, and in the neighbouring villages, that the sources of the Orinoco, which we found east of the Esmeralda, and in the missions of the Carony and at Angostura, that the sources of the Rio Branco are the native spots of the green stones. These statements confirm the report of an old soldier of the

- The winter temperature at London and Paris is $4.2^{\circ}$ and $3.7^{\circ}$; at Montpelier, $6.7^{\circ}$; at Rome, $7.7^{\circ}$. In that part of Mexico, and the Terra Firma, where we saw the most active species of the sarsaparilla growing, (that which supplies the trade of the Spanish and Portuguese colonies) the temperature is from twenty to twenty-six degrees. The roots of another family of monocotyledons (of some cyperaceax) possess also diaphoretic and resolvent properties. The Carex arenaria, the C. hirta, \&cc. furnish the German sarsaparilla of druggists. According to Clusius, Europe received the first sarsaparilla from Yucatan, and the island of Puna, opposite Guayaquil.
$\dagger$ This word is of the Tamanac language; these women are the sole Donne of the Italian missionaries.
garrison of Cayenne (mentioned by La Condamine), who affirmed that these mineral substances were obtained from the "country of women," west of the rapids of the Oyapoc. The Indians who inhabit the fort of Topayos on the Amazon, five degrees east of the mouth of the Rio Negro, possessed formerly a great number of these stones. Had they received them from the north, that is, from the country pointed out by the Indians of the Rio Negro, which extends from the mountains of Cayenne towards the sources of the Essequibo, the Carony, the Orinoco, the Parime, and the Rio Trombetas? or did they come from the south by the Rio Topayos, which descends from the vast table-land of the Campos Parecis? Superstition attaches great importance to these mineral substances : they are worn suspended from the neck as amulets, because, according to popular belief, they preserve the wearer from nervous complaints, fevers, and the stings of venomous serpents. They have consequently been for ages an article of trade among the natives, both north and south of the Orinoco. The Caribs, who may be considered as the Bucharians of the New World, made them known along the coasts of Guiana; and the same stones, like money in circulation, passed successively from nation to nation in opposite directions: their quantity is perhaps not augmented, and the spot which produces them is probably unknown rather than concealed. In the midst of enlightened Europe, on occasion of a warm contest respecting native bark, a few years ago, the green stones of the Orinoco were gravely proposed as a powerful febrifuge. After this appeal to the credulity of Europeans, we cannot be surprised to learn that the Spanish planters share the predilection of the Indians for these amulets, and that they are sold at a very considerable price. The form given to them most frequently is that of the Babylonian cylinders,* longitudinally perforated, and loaded with inscriptions and figures. But this is not the work of the Indians of our days, the natives of the Orinoco and the Amazon, whom we find in the last degree of barbarism. The Amazon stones, like the perforated and sculptured emeralds, found in the Cordilleras of New Grenada and Quito, are vestiges of anterior civilization.

[^302]The present inhabitants of those countries, particularly in - the hot region, so little comprehend the possibility of cutting hard stones, (the emerald, jade, compact feldspar and . rock-crystal, ) that they imagine the green stone is soft when taken out of the earth, and that it hardens after having been moulded by the hand.

The natural soil of the Amazon-stone is not in the valley of the river Amazon. It does not derive its name from the river, but like the river itself, the stone has been named after a nation of warlike women, whom Father Acunha, and Oviedo, in his letter to cardinal Bembo, compare to the Amazons of the ancient world. What we see in our cabinets under the false denomination of Amazon-stone, is neither jade, nor compact feldspar, but a common feldspar of an apple-green colour, that comes from the Ural mountains and on lake Onega in Russia, but which I never saw in the granitic mountains of Guiana. Sometimes also this very rare and hard Amazon-stone is confounded with the hatchetnephrite (beilstein)* of Werner, which has much less tenacity. The substance which I obtained from the hands of the Indians, belongs to the saussurite, $\dagger$ to the real jade, which resembles compact feldspar, and which forms one of the constituent parts of the verde de Corsica, or gabbro. $\ddagger$ It takes a fine polish, and passes from apple-green to emeraldgreen ; it is translucent at the edges, extremely tenacious, and in a high degree sonorous. These Amazon stones were formerly cut by the natives into very thin plates, perforated at the centre, and suspended by a thread, and these plates yield an almost metallic sound if struck by another hard body. \| This fact confirms the connection which we find, notwithstanding the difference of fracture and of specific gravity between the saussurite and the siliceous basis of the porphyrschiefer, which is the phonolite (klingstein). I have

* Punamustein (jade axinien). The stone hatchets found in America, for instance in Mexico, are not of beiletein, but of compact feldspar.
$\dagger$ Jade of Saussure, according to the system of Brongniart ; tenacions jade, and compact tenacious feldspar of Hally; some varieties of the variolithe of Werner.
$\ddagger$ Euphotide of Hauy, or schillerfels of Raumer.
$\|$ M. Brongniart, to whom I showed these plates on my return to Europe, very justly compared these jades of Parime to the sonorous stones employed by the Chinese in their musical instruments called king.
already observed, that, as it is very rare to find in America nephrite, jade, or compact feldspar, in its native place, we may well be astonished at the quantity of hatchets which are everywhere discovered in digging the earth, from the banks of the Ohio as far as Chile. We saw in the mountains of Upper Orinoco, or of Parime, only granular granites containing a little hornblende, granites passing into gneiss, and schistoid hornblendes. Has nature repeated on the east of Esmeralda, between the sources of the Carony, the Essequibo, the Orinoco, and the Bio Branco, the tran-sition-formation of Tucutunemo reposing on mica-schist? Does the Amazon-stone come from the rocks of euphotide, which form the last member of the series of primitive rocks?

We find among the inhabitants of both hemispheres, at the first dawn of civilization, a peculiar predilection for certain stones; not only those which, from their hardness, may be useful to man as cutting instruments, but also for mineral substances, which, on account of their colour and their natural form, are believed to bear some relation to the organic functions, and even to the propensities of the soul. This ancient worship of stones, these benign virtues attributed to jade and hæmatite, belong to the savages of America as well as to the inhabitants of the forests of Thrace. The human race, when in an uncultivated state, believes itself to have sprung from the ground; and feels as if it were enchained to the earth, and the substances contained in her bosom. The powers of nature, and still more those which destroy than those which preserve, are the first objects of its worship. It is not solely in the tempest, in the sound that precedes the earthquake, in the fire that feeds the volcano, that these powers are manifested; the inanimate rock; stones, by their lustre and hardness; mountains, by their mass and their solitude; act upon the untaught mind with a force which, in a state of advanced civilization, can no longer be conceived. This worship of stones, when once established, is preserved amidst more modern forms of worship ; and what was at first the object of religious homage, becomes a source of superstitious confidence. Divine stones are transformed into amulets, which are believed to preserve the wearer from every ill, mental and corporeal. Although a distance of five hundred leagues separates the banks of the

Amazon and the Orinoco from the Mexican table-land; although history records no fact that connects the savage nations of Guiana with the civilized nations of Anahuac, the monk Bernard de Sahagun, at the beginning of the conquest, found preserved as relics at Cholula, certain green stones which had belonged to Quetzalcohuatl. This mysterious personage is the Mexican Buddha; he appeared in the time of the Toltecs, founded the first religious associations, and estabfished a government similar to that of Meroë and of Japan.

The history of the jade, or the green stones of Guiana, is intimately connected with that of the warlike women whom the travellers of the sixteenth century named the Amazons of the New World. La Condamine has produced many testimonies in favour of this tradition. Since my return from the Orinoco and the river Amazon, I have often been asked, at Paris, whether I embraced the opinion of that learned man, or believed, like several of his contemporaries, that he undertook the defence of the Cougnantainsecouima, (the independent women who received men into their society only in the month of April), merely to fix, in a public sitting of the Academy, the attention of an audience somewhat eager for novelties. I may take this opportunity of expressing my opinion on a tradition which has so romantic an appearance; and I am farther led to do this as Lz Condamine asserts that the Amazons of the Rio Cayame* crossed

* Orellana, arriving at the Marafion by the Rio Coca and the Napo, fought with the Amazons, as it appears, between the mouth of the Rio Negro and that of the Xingu. La Condamine asserts, that in the seventeenth century they passed the Marafion between Tefe and the month of the Rio Puruz, near the Canfo Cuchivara, which is a western branch of the Puruz. These women therefore came from the banks of the Rio Cayame, or Cayambe, consequently from the unknown country which extends south of the Marafion, between the Ucayale and the Madeira. Raleigh also places them on the south of the Marafion, but in the province of Topayos, and on the river of the same name. He says they were " rich in golden vessels, which they had acquired in exchange for the famous green stones, or piedras hijadas." (Raleigh means, no doubt, piedras del higado, stones that cure diseases of the liver.). It is remarkable enough, that, one hundred and forty-eight years after, La Condamine still found those green stones (divine stones), which differ neither in colour nor in hardness from oriental jade, in greater numbers among the Indians who live near the mouth of the Rio Topayos, than elsewhere. The Indians said that they inherited these stones, which cure
the Marañon to establish themselves on the Rio Negro. A taste for the marvellous, and a wish to invest the descriptions of the New Continent with some of the colouring of classic antiquity, no doubt contributed to give great importance to the first narratives of Orellana. In perusing the works of Vespucci, Fernando Columbus, Geraldini, Oviedo, and Pietro Martyr, we recognize this tendency of the writers of the sixteenth century to find among the newly discovered nations all that the Greeks have related to us of the first age of the world, and of the manners of the barbarous Scythians and Africans. But if Oviedo, in addressing his letters to cardinal Bembo, thought fit to flatter the taste of a man so familiar with the study of antiquity, Sir Walter Raleigh had a less poetic aim. He sought to fix the attention of Queen Elizaheth on the great empire of Guiana, the conquest of which he proposed. He gave a description of the rising of that gilded king (el dorado)," whose chamberlains, furnished with long tubes, blew powdered gold every morning over his body, after having rubbed it over with aromatic oils : but nothing could be better adapted to strike the imagination of queen Elizabeth, than the warlike republic of women without husbands, who resisted the Castilian heroes. Such were the motives which prompted exaggeration on the part of those writers who have given most reputation to the Amazons of America; but these motives do not, I think, suffice for entirely rejecting a tradition, which is spread among various nations having no communications one with another.

Thirty years after La Condamine visited Quito, a Portuguese astronomer, Ribeiro, who has traversed the Amazon, and the tributary streams which run into that river on the northern side, has confirmed on the spot all that the learned Frenchman had advanced. He found the same traditions among the Indians; and he collected them with the greater, impartiality as he did not himself believe that the Amazons

[^303]formed a separate horde. Not knowing any of the tongues spoken on the Orinoco and the Rio Negro, I could learn nothing certain respecting the popular traditions of the women without husbands, or the origin of the green stones, which are believed to be intimately connected with them. I shall, however, quote a modern testimony of some weight, that of Father Gili. "Upon inquiring," says this wellinformed missionary, of a Quaqua Indian, what nations inhabited the Rio Cuchivero, he named to me the Achirigotos, the Pajuros, and the Aikeambenanos.* Being well acquainted," pursues he, "with the Tamanac tongue, I instantly comprehended the sense of this last word, which is a compound, and signifies 'women living alone.' The Indian confirmed my observation, and related that the Aikeambenanos were a community of women, who manufactured blowtubes, $t$ and other weapons of war. They admit, once a year, the men of the neighbouring nation of Vokearos into their society, and send them back with presents. All the male children born in this horde of women are killed in their infancy." This history seems framed on the traditions which circulate among the Indians of the Marañon, and among the Caribs; yet the Quaqua Indian, of whom Father Gili speaks, was ignorant of the Castilian language; he had never had any communication with white men; and certainly knew not, that south of the Orinoco there existed another river, called the river of the 'Aikeambenanos,' or 'Amazons.'

What must we conclude from this narration of the old missionary of Encaramada? Not that there are Amazons on the banks of the Cuchivero, but that women in different parts of America, wearied of the state of slavery in which they were held by the men, united themselves together; that the desire of preserving their independence rendered them warriors; and that they received visits from a neighbouring and friendly horde. This society of women may have acquired some power in one part of Guiana. The Caribs of the continent held intercourse with those of the islands; and no doubt in this way the traditions of the Marañon and the Orinoco were propagated toward the north. Before the

* In Italian, Acchirecolti, Pajuri, and Aicheam-benano.
$\dagger$ Long tubes made from a hollow cane, which the natives use to propel their poisoned arrows.

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voyage of Orellana, Christopher Columbus imagined he had found the Amazons in the Caribbee Islands. This great man was told, that the small island of Madanino (Montserrat) was inhabited by warlike women, who lived the greater part of the year separate from men. At other times also, the conquistadores imagined that the women, who defended their huts in the absence of their husbands, were republics of Amazons; and, by an error less excusable, formed a like supposition respecting the religious congregations, the convents of Mexican virgins, who, far from admiting men at any season of the year into their society, lived according to the austere rule of Quctzalcohuatl. Such was the disposition of men's minds, that in the long succession of travellers, who crowded on each other in their discoveries and in narrations of the marvels of the New World, every one readily declared he had seen what his predecessors had announced.

We passed three nights at San Carlos del Rio Negro. 1 count the nights, because I watched during the greater part of them, in the hope of seizing the moment of the passage of some star over the meridian. That I might have nothing to reproach myself with, I kept the instruments always ready for an observation. I could not even obtain double altitudes, to calculate the latitude by the method of Douwes. What a contrast between two parts of the same zone; between the sky of Cumana, where the air is constantly pure as in Persia and Arabia, and the sky of the Rio Negro, veiled like that of the Feroe islands, without sun, or moon, or stars!

On the 10th of May, our canoe being ready before sumrise, we embarked to go up the Rio Negro as far as the mouth of the Cassiquiare, and to devote ourselves to researches on the real course of that river, which unites the Orinoco to the Amazon. The morning was fine; but, in proportion as the heat augmented, the sky became obscured. The air is so saturated by water in these forests, that the vesicular vapours become visible on the least increase of evaporation at the surface of the earth. The breeze being, never felt, the humid strata are not displaced and renewed by dryer air. We were every day more grieved at the aspect of the cloudy sky. M. Bonpland was losing by this excessive humidity the plants he had collected; and I, for
my part, was afraid lest I should again find the fogs of the Rio Negro in the valley of the Cassiquiare. No one in these missions for half a century past had doubted the existence of communication between two great systems of rivers; the important point of our voyage was confined therefore to fixing by astronomical observations the course of the Cassiquiare, and particularly the point of its entrance into the Rio Negro, and that of the bifurcation of the Orinoco. Without a sight of the sun and the stars this object would be frustrated, and we should have exposed ourselves in vain to long and painful privations. Our fellow travellers would have returned by the shortest way, that of the Pimichin and the small rivers; but M. Bonpland preferred, like me, persisting in the plan of the voyage, which we had traced for ourselves in passing the Great Cataracts. We had already travelled one hundred and eighty leagues in a boat from San Fernando de Apure to San Carlos, on the Rio Apure, the Orinoco, the Atabapo, the Temi, the Tuamini, and the Rio Negro. In again entering the Orinoco by the Cassiquiare we had to navigate three hundred and twenty leagues, from San Carlos to Angostura. By this way we had to struggle against the currents during ten days; the rest was to be performed by going down the stream of the Orinoco. It would have been blamable to have suffered ourselves to be discouraged by the fear of a cloudy sky, and by the mosquitos of the Cassiquiare. Our Indian pilot, who had been recently at Mandavaca, promised us the sun, and "those great stars that eat the clouds," as soon as we should have left the black waters of the Guaviare. We therefore carried out our first project of returning to San Fernando de Atabapo by the Cassiquiare ; and, fortunately for our researches, the prediction of the Indian was verified. The white waters brought us by degrees a more serene sky, stars, mosquitos, and crocodiles.

We passed between the islands of Zaruma and Mini, or Mibita, covered with thick vegetation; and, after having ascended the rapids of the Piedra de Uinumane, we entered the Rio Cassiquiare at the distance of eight miles from the small fort of San Carlos. The Piedra, or granitic rock which forms the little cataract, attracted our attention on account of the numerous veins of quartz by which it is 2 D 2
traversed. These veins are several inches broad, and their masses proved that their date and formation are very different. I saw distinctly that, wherever they crossed each other, the veins containing mica and black schorl traversed and drove out of their direction those which contained only white quartz and feldspar. According to the theory of Werner, the black veins were consequently of a more recent formation than the white. Being a disciple of the school of Freyberg, I could not but pause with satisfaction at the rock of Uinumane, to observe the same phenomena near the equator, which $I$ had so often seen in the mountains of my own country. I confess that the theory which considers veins as clefts filled from above with various substances, pleases me somewhat less now than it did at that period; but these modes of intersection and driving aside, observed in the stony and metallic veins, do not the less merit the attention of travellers as being one of the most general and constant of geological phenomena. On the east of Javita, all along the Cassiquiare, and particularly in the mountains of Duida, the number of veins in the granite increases. These veins are full of holes and druses; and their frequency seems to indicate that the granite of these countries is not of very ancient formation.

We found some lichens on the rock Uinumane, opposite the island of Chamanare, at the edge of the rapids; and as the Cassiquiare near its mouth turns abruptly from east to south-west, we saw for the first time this majestic branch of the Orinoco in all its breadth. It much resembles the Rio Negro in the general aspect of the landscape. The trees of the forest, as in the basin of the latter river, advance as far as the beach, and there form a thick coppice; but the Cassiquiare has white waters, and more frequently changes its direction. Its breadth, near the rapids of Uinumane, almost surpasses that of the Rio Negro. I found it everywhere from two hundred and fifty to two hundred and eighty toises, as far as above Vasiva. Before we passed the island of Garigave, we perceived to the north-east, almost at the horizon, a little hill with a hemispheric summit; the form -which in every zone characterises mountains of granite. Continually surrounded by vast plains, the solitary rocks and bills excite the attention of the traveller. Contiguous
mountains are only found more to the east, towards the sources of the Pacimoni, Siapa, and Mavaca. Having arrived on the south of the Raudal of Caravine, we perceived that the Cassiquiare, by the windings of its course, again approached San Carlos. The distance from this fort to the mission of San Francisco Solano, where we slept, is only two leagues and a half by land, but it is reckoned seven or eight by the river. I passed a part of the night in the open air, waiting vainly for stars. The air was misty, notwithstanding the aguas blancas, which were to lead us beneath an ever-starry sky.

The mission of San Francisco Solano, situated on the left bank of the Cassiquiare, was founded, as were most of the Christian settlements south of the Great Cataracts of the Orinoco, not by monks, but by military authority. At the time of the expedition of the boundaries, villages were built in proportion as a subteniente, or a corporal, advanced with his troops. Part of the natives, in order to preserve their independence, retired without a struggle; others, of whom the most powerful chiefs had been gained, joined the missions. Where there was no church, they contented themselves with erecting a great cross of red wood, close to which they constructed a casa fuerte, or block-house, the walls of which were formed of large beams resting horizontally upon each other. This house had two stories; in the upper story two cannon of small calibre were placed; and two soldiers lived on the ground-floor, and were served by an Indian family. Those of the natives with whom they were at peace cultivated spots of land round the casa fuerte. The soldiers called them together by the sound of the horn, or a botuto of baked earth, whenever any hostile attack was dreaded. Such were the pretended nineteen Christian settlements founded by Don Antonio Santos in the way from Esmeralda to the Erevato. Military posts, which had no influence on the civilization of the natives, figured on the maps, and in the works of the missionaries, as villages (pueblos) and reducciones apostolicas.* The preponderance of the military was maintained on the banks of the Orinoco till 1785, when the system of the monks of San Francisco

[^304]began. The small number of missions founded, or rather re-established, since that period, owe their existence to the Fathers of the Observance; for the soldiers now distributed among the missions are dependent on the missionaries, or at least are reputed to be so, according to the pretensions of the ecclesiastical hierarchy.

The Indians whom we found at San Francisco Solano were of two nations; Pacimonales and Cheruvichahenas. The latter being descended from a considerable tribe settled on the Rio Tomo, near the Manivas of the Upper Guainia, I tried to gather from them some ideas respecting the upper course and the sources of the Rio Negro; but the interpreter whom I employed could not make them comprehend my questions. Their continually-repeated answer was, that the sources of the Rio Negro and the Inirida were as near to each other as "two fingers of the hand." In one of the huts of the Pacimonales we purchased two fine large birds, a toucan (piapoco) and an ana, a species of macaw, seventeen inches long, having the whole body of a purple colour. We had already in our canoe seven parrots, two manakins (pipa), a motmot, two guans, or pavas de monte, two manaviris (cercoleptes or Viverra caudivolvula), and eight monkeys, namely, two ateles,* two titis, $\dagger$ one viudita, $\ddagger$ two douroucoulis or nocturnal monkeys, $\|$ and a short-tailed cacajao. § Father Zea whispered some complaints at the daily augmentation of this ambulatory collection. The toucan resembles the raven in manners and intelligence. It is a courageous animal, but easily tamed. Its long and stout beak serves to defend it at a distance. It makes itself master of the house, steals whatever it can come at, and loves to bathe often and fish on the banks of the river. The toucan we had bought was very young; yet it took delight, during the whole voyage, in teasing the cusicusis, or nocturnal monkeys, which are melancholy and irritable. I did not observe what has been related in some works of natural history, that the toucan is forced, from the structure

* Marimonda of the Great Cataracts, (Simia belzebuth, Brisson.)
+ Simia sciurea, the saimiri of Buffon. $\ddagger$ Simia lugens.
\| Cusiensi, or Simia trivirgata.
§ Simia melanocephala, (mono feo.) These last three species are new.
of its beak, to swallow its food by throwing it up into the air. It raises it indeed with some difficulty from the ground, but, having once seized it with the point of its enormous beak, it has only to lift it ap by throwing back its head, and holding it perpendicularly whilst in the act of swallowing. This bird makes extraordinary gestures when preparing to drink. The monks say that it makes the sign of the cross upon the water; and this popular belief has obtained for the toucan, from the creoles, the singular name of diostede.*

Most of our animals were confined in small wicker cages; others ran at full liberty in all parts of the boat. At the approach of rain the macaws sent forth noisy cries, the toucan wanted to reach the shore to fish, and the little monkeys (the titis) went in search of Father Zea, to take shelter in the large sleeves of his Franciscan habit. These incidents sometimes amused us so much that we forgot the torment of the mosquitos. At night we placed a leather case (petaca), containing our provisions, in the centre.; then our instruments, and the cages of our animals; our hammocks were suspended around the cages, and beyond were those of the Indians. The exterior circle was formed by the fires which are lighted to keep off the jaguars. Such was the order of our encampment on the banks of the Cassiquiare. The Indians often spoke to us of a little nocturnal animal, with a long nose, which surprises the young parrots in their nests, and in eating makes use of its hands like the monkeys and the maniveris, or kinkajous. They call it the guachi; it is, no doubt, a coati, perhaps the Viverra nasua, which I saw wild in Mexico. The missionaries gravely prohibit the natives from eating the flesh of the guachi, to which, according to far-spread superstitious ideas, they attribute the same stimulating qualities which the people of the East believe to exist in the skink, and the Americans in the flesh of the alligator.

On the 11th of May, we left the mission of San Francisco Solano at a late hour, to make but a short day's journey. The uniform stratum of vapours began to be divided into clouds with distinct outlines: and there was a

* Dios te dd, God gives it thee.
light east wind in the upper regions of the air. We recognized in these signs an approaching change of the weather; and were unwilling to go far from the mouth of the Cassiquiare, in the hope of observing during the following night the passage of some star over the meridian. We descried the Caño Daquiapo to the south, the Guachaparu to the north, and a few miles further, the rapids of Cananivacari. The velocity of the current being 6.3 feet in a second, we had to struggle against the turbulent waves of the Raudal. We went on shore, and M. Bonpland discovered within a few steps of the beach a majestic almendron, or Bertholletia excelsa. The Indians assured us, that the existence of this valuable plant of the banks of the Cassiquiare was unknown at San Francisco Solano, Vasiva, and Esmeralda. They did not think that the tree we saw, which was more than sixty feet high, had been sown by some passing traveller. Experiments made at San Carlos have shown how rare it is to succeed in causing the bertholletia to germinate, on account of its. ligneous pericarp, and the oil contained in its nut, which so readily becomes rancid. Perhaps this tree denoted the existence of a forest of bertholletia in the inland country on the east and north-east. We know, at least, with certainty, that this fine tree grows wild in the third degree of latitude, in the Cerro de Guanaya. The plants that live in society have seldom marked limits, and it happens, that before we reach a palmar or a pinar," we find solitary palmtrees and pines. They are somewhat like colonists that have advanced in the midst of a country peopled with different vegetable productions.

Four miles distant from the rapids of Cunanivacari, rocks of the strangest form rise in the plains. First appears a narrow wall eighty feet high, and perpendicular ; and at the southern extremity of this wall are two turrets, the courses of which are of granite, and nearly horizontal. The grouping of the rocks of Guanari is so symmetrical that they might be taken for the ruins of an ancient edifice. Are they the remains of islets in the midst of an inland sea, that covered the flat ground between the Sierra Parime and the Parecis

[^305]mountains?* or have these walls of rock, these turrets of granite, been upheaved by the elastic forces that still act in the interior of our planet? We may be permitted to meditate a little on the origin of mountains, after having seen the position of the Mexican volcanos, and of trachyte summits on an elongated crevice; having found in the Andes of South America primitive and volcanic rocks in a straight line in the same chain; and when we recollect the island, three miles in circumference, and of a great height, which in modern times issued from the depths of the ocean near Oonalaska.

The banks of the Cassiquiare are adorned with the chiriva palm-tree with pinnate leaves, silvery on the under part. The rest of the forest furnishes only trees with large, coriaceous, glossy leaves, that have plain edges. This peculiar physiognomy $\dagger$ of the vegetation of the Guainia, the Tuamini, and the Cassiquiare, is owing to the preponderance of the families of the guttiferm, the sapotm, and the laurinem, in the equatorial regions. The serenity of the sky promising us a fine night, we resolved, at five in the evening, to rest near the Piedra de Culimacari, a solitary granite rock, like all those which I have described between the Atabapo and the Cassiquiare. We found by the bearings of the sinuosities of the river, that this rock is nearly in the latitude of the mission of San Francisco Solano. In those desert countries, where man has hitherto lefl only fugitive traces of his existence, I constantly endeavoured to make my observations near the mouth of a river, or at the foot of a rock distinguishable by its form. Such points only as are immutable by their nature can serve for the basis of geographical maps. I obtained, in the night of the 10th of May, a good observation of latitude by a of the Southern Cross; the longitude was determined, but with less precision, by the chronometer,

[^306]taking the altitudes of the two beautiful stars which shme in the feet of the Centaur: This observation made known to us at the same time, with sufficient precision for the purposes of geography, the positions of the mouth of the Pacimoni, of the fortress of San Carlos, and of the junction of the Cassiquiare with the Rio Negro. The rock of Culimacari is precisely in latitude $2^{\circ} 0^{\circ} 42^{\prime \prime}$, and probably in longitude $69^{\circ} 33^{\prime} 50^{\prime \prime}$.

Satisfied with our observations, we left the rock of Culimacari at half past one on the morning of the 12th. The torment of mosquitos, to which we were exposed, augmented in proportion as we withdrew from the Rio Negro. There are no zancudos in the valley of Cassiquiare, but the simulia, and all the other insects of the tipulary family, are the more numerous and venomous. Having still eight nights to pass in the open air in this damp and unhealthy climate, before we could reach the mission of Esmeralda, our pilot sought to arrange our passage in such a manner as might enable us to enjoy the hospitality of the missionary of Mandavaca, and some shelter in the village of Vasiva. We went up with difficulty against the current, which was nine feet, and in some places (where I measured it with precision) eleven feet eight inches in a second, that is, almost eight miles an hour. Our resting-place was probably not farther than three leagues in a right line from the mission of Mandavaca; yet, though we had no reason to complain of inactivity on the part of our rowers, we were fourteen hours in making this short passage.

Towards sunrise we passed the mouth of the Rio Pacimoni, a river which I mentioned when speaking of the trade in sarsaparilla, and which (by means of the Baria) intertwines in so remarkable a way with the Cababuri. The Pacimoni rises in a hilly ground, from the confluence of three small rivers,* not marked on the maps of the missionaries. Its waters are black, but less so than those of the lake of Vasiva, which also communicates with the Cassiquiare. Between those two tributary streams coming from the east, lies the mouth of the Rio Idapa, the waters of which are white. I shall not recur again to the difficulty of

[^307]explaining this coexistence of rivers differently coloured, within a small extent of territory, but shall merely observe', that at the mouth of the Pacimoni, and on the borders of the lake Vasiva, we were again struck with the purity and extreme transparency of the brown waters. Ancient Arabian travellers have observed, that the Alpine branch of the Nile, which joins the Bahr el Abiad near Halfaja, has green waters, which are so transparent, that the fish may be seen at the bottom of the river.

We passed some turbulent rapids before we reached the mission of Mandavaca. The village, which bears also the name of Quirabuena, contains only sixty natives. The state of the Christian settlements is in general so miserable, that, in the whole course of the Cassiquiare, on a length of fitty leagues, not two hundred inhabitants are found. The bauks of this river were indeed more peopled before the arrival of the missionaries; the Indians have withdrawn into the woods, toward the east; for the western plains are almost deserted. The natives subsist during a part of the year on those large ants of which $I$ have spoken above. These insects are much esteemed here, as spiders are in the southern hemisphere, where the savages of Australia deem them delicious. We found at Mandavaca the good old missionary, who had already spent "twenty years of mosquitos in the bosques del Cassiquiare," and whose legs were so spotted by the stings of insects, that the colour of the skin could scarcely be perceived. He talked to us of his solitude, and of the sad necessity which often compelled him to leave the most atrocious crimes unpunished in the two missions of Mandavaca and Vasiva. In the latter place, an Indian alcalde had, a few years before, eaten one of his wives, after having taken her to his conuco,* and fattened her by good feeding. The cannibalism of the nations of Guiana is never caused by the want of subsistence, or by the superstitions of their religion, as in the islands of the South Sea; but is generally the effect of the vengeance of a conqueror, and (as the missionaries say) " of a vitiated appetite." Victory over a hostile tribe is celebrated by a repast, in which some parts of the body of a prisoner are devoured. Sometimes a

* A hut surrounded with cultivated ground; a sort of country-house, which the natives prefer to residing in the misaions.
defenceless family is surprised in the night; or an enemy, who is met with by chance in the woods, is killed by a poisoned arrow. The body is cut to pieces, and carried as a trophy to the hut. It is civilization only, that has made man feel the unity of the human race; which has revealed to him, as we may say, the ties of consanguinity, by which he is linked to beings to whose language and manners he is a stranger. Savages know only their own family; and a tribe appears to them but a more numerous assemblage of relations. When those who inhabit the missions see Indians of the forest, who are unknown to them, arrive, they make use of an expression, which has struck us by its simple candour; "they are, no doubt, my relations: I understand them when they speak to me." But these very savages detest all who are not of their family, or their tribe; and hunt the Indians of a neighbouring tribe, who live at war with their own, as we hunt game. They know the duties of family ties and of relationship, but not those of humanity, which require the feeling of a common tie with beings framed like ourselves. No emotion of pity prompts them to spare the wives or children of a hostile race; and the latter are devoured in preference, at the repast given at the conclusion of a battle or warlike incursion.

The hatred which savages for the most part feel for men who speak another idiom, and appear to them to be of an inferior race, is sometimes rekindled in the missions, after having long slumbered. A short time before our arrival at Esmeralda, an Indian, born in the forest* behind the Duida, travelled alone with another Indian, who, after having been made prisoner by the Spaniards on the banks of the Ventuario, lived peaceably in the village, or, as it is expressed here, "" within the sound of the bell," (debaxo de la campaña.) The latter could only walk slowly, because he was suffering from one of those fevers to which the natives are subject, when they arrive in the missions, and abruptly change their diet. Wearied by his delay, his fellow-traveller

[^308]killed him, and hid the body behind a copse of thick trees, near Esmeralda. This crime, like many others among the Indians, would have remained unknown, if the murderer had not made preparations for a feast on the following day. He tried to induce his children, born in the mission and become Christians, to go with him for some parts of the dead body. They had much difficulty in persuading him to desist from his purpose; and the soldier who was posted at Esmeralda, learned from the domestic squabble caused by this event, what the Indians would have concealed from his knowledge.

It is known that cannibalism and the practice of human sacrifices, with which it is often connected, are found to exist in all parts of the globe, and among people of very different races; ; but what strikes us more in the study of history is to see human sacrifices retained in a state of civilization somewhat advanced; and that the nations who hold it a point of honour to devour their prisoners are not always the rudest and most ferocious. The painful facts have not escaped the observation of those missionaries who are sufficiently enlightened to reflect on the manners of the surrounding tribes. The Cabres, the Guipuñaves, and the Caribs, have always been more powerful and more civilized than the other hordes of the Orinoco; and yet the two former are as much addicted to anthropophagy as the latter are repugnant to it. We must carefully distinguish the different branches into which the great family of the Caribbee nations is divided. These branches are as numerous as those of the Mongols, and the western Tartars, or Turcomans. The Caribs of the continent, those who inhabit the plains between the Lower Orinoco, the Rio Branco, the Essequibo, and the sources of the Oyapoc, hold in horror the practice of devouring their enemies. This barbarous custom, $\dagger$ at the first discovery of America,

[^309]existed only among the Caribs of the West Indies. It is they who have rendered the names of cannibals, Caribbees, and anthropophagi, synonymous; it was their cruelties that prompted the law promulgated in 1504, by which the Spaniards were permitted to make a slave of every individual of an American nation which could be proved to be of Caribbee origin. I believe, however, that the anthropophagy of the inhabitants of the West India Islands was much exaggerated by early travellers, whose stories Herrera, a. grave and judicious historian, has not disdained to repeat in his Decades historicas. He has even credited that extraordinary event which led the Caribs to renounce this barbarous custom. The natives of a little island devoured a Dominican monk whom they had carried off from the coast of Porto Rico; they all fell sick, and would never again eat monk or layman."

If the Caribs of the Orinoco, since the commencement of the sixteenth century, have differed in their manners from those of the West India Islands; if they are unjustly accused of anthropophagy; it is difficult to attribute this difference to any superiority of their social state. The strangest contrasts are found blended in this mixture of nations, some of whom live only upon fish, monkeys, and ants; while others are more or less cultivators of the ground, more or less occupied in making and painting pottery, or weaving hammocks or cotton cloth. Several of the latter tribes have preserved inhuman customs altogether unknown to the former. "You cannot imagine," said the old missionary of Mandavaca, "the perversity of this Indian race (familia de Indios). You receive men of a new tribe into the village; they appear to be mild, good,
incolebant feri trucesque, qui puerorum et virorum carnibus, quos aliis in insulis bello aut latrociniis cepissent, vescebantur; a feminis abstinebant; Canibales appellati."-" Some of the islands are inhabited by a cruel and savage race, called cannibals, who eat the flesh of men and boys, and captives and slaves of the male sex, abstaining from that of females." (Hist. Venet., 1551.) The custom of sparing the lives of female prisoners confirms what I have previously said, p. 326, of the language of the women. Does the word cannibal, applied to the Caribs of the West India Islands, belong to the language of this archipelago (that of Hayti)? or must we seek for it in an idiom of Florida, which some traditions indicate as the first country of the Caribs ?
and laborious; but suffer them to take part in an incursion (entrada) to bring in the natives, and you can scarcely prevent them from murdering all they meet, and hiding some portions of the dead bodies." In reflecting on the manners of these Indians, we are almost horrified at that combination of sentiments which seem to exclude each other; that faculty of nations to become but partially humanized; that preponderance of customs, prejudices, and traditions, over the natural affections of the heart. We had a fugitive Indian from the Guaisia in our canoe, who had become sufficiently civilized in a few weeks to be useful to us in placing the instruments necessary for our observations at night. He was no less mild than intelligent, and we had some desire of taking him into our service. What was our horror when, talking to him by means of an interpreter, we learned, "that the flesh of the marimonde monkeys, though blacker, appeared to him to have the taste of human flesh." He told us "that his relations (that is, the people of his tribe) preferred the inside of the hands in man, as in bears." This assertion was accompanied with gestures of savage gratification. We inquired of this young man, so calm and so affectionate in the little services which he rendered us, whether he still felt sometimes a desire to eat of a Cheruvichahena. He answered, without discomposure, that, living in the mission, he would only eat what he saw was eaten by the Padres. Reproaches addressed to the natives on the abominable practice which we here discuss, produce no effect; it is as if a Brahmin, travelling in Europe, were to reproach us with the habit of feeding on the flesh of animals. In the eyes of the Indian of the Guaisia, the Cheruvichahena was a being entirely different from himself; and one whom he thought it was no more unjust to kill than the jaguars of the forest. It was merely from a sense of propriety that, whilst he remained in the mission, he would only eat the same food as the Fathers. The natives, if they return to their tribe (al monte), or tind themselves pressed by hunger, soon resume their old habits of anthropophagy. And why should we be so much astonished at this inconstancy in the tribes of the Orinoco, when we are reminded, by terrible and well-ascertained examples, of what has passed among civilized nations in
times of great scarcity? In Egypt, in the thirteenth century, the habit of eating human flesh pervaded all classes of society; extraordinary snares were spread for physicians in particular. They were called to attend persons who pretended to be sick, but who were only hungry; and it was not in order to be consulted, but devoured. An historian of great veracity, Abd-allatif, has related how a practice, which at first inspired dread and horror, soon occasioned not even the slightest surprise."*

Although the Indians of the Cassiquiare readily return to their barbarous habits, they evince, whilst in the missions, intelligence, some love of labour, and, in particular, a great facility in learning the Spanish language. The villages being, for the most part, inhabited by three or four tribes, who do not understand each other, a foreign idiom, which is at the same time that of the civil power, the language of the missionary, affords the advantage of more general means of communication. I heard a Poiñave Indian conversing in Spanish with a Guahibo, though both had come from their forests within three months. They uttered a phrase every quarter of an hour, prepared with difficulty, and in which the gerund of the verb, no doubt according to the grammatical turn of their own languages, was constantly

* "When the poor began to eat human flesh, the horror and astonishment caused by repasts so dreadful were such that these crimes furnished the never-ceasing subject of every conversation. But at length the people became so accustomed to it, and conceived such a taste for this detestable food, that people of wealth and respectability were found to use it as their ordinary food, to eat it by way of a treat, and even to lay in a stock of it. This flesh was prepared in different ways, and the practice being once introduced, spread into the provinces, so that instances of it were found in every part of Egypt. It then no longer caused any surprise; the horror it had at first inspired vanished; and it was mentioned as an indifferent and ordinary thing. This mania of devouring one another became so common among the poor, that the greater part perished in this manner. These wretches employed all sorts of artifices, to seize men by surprise, or decoy them into their houses under false pretences. This happened to three physicians among those who visited me; and a bookseller who sold me books, an old and very corpulent man, fell into their snares, and escaped with great difficulty. All the facts which we relate as eye-witnesses fell under our observation accidentally, for we generally avoided witnessing spectacles which inspired us with so much horror."Account of Egypt by Abd-allatif, physician of Bagdad, translated into French by De Sacy, p. 360-374.
employed. "When I seeing Padre, Padre to me saying;"* instead of, "when I saw the missionary, he said to me." I have mentioned in another place, how wise it appeared to me in the Jesuits to generalize one of the languages of civilized America, for instance that of the Peruvians, $\dagger$ and instruct the Indians in an idiom which is foreign to them in its roots, but not in its structure and grammatical forms. This was following the system which the Incas, or kingpriests of Peru had employed for ages, in order to humanize the barbarous nations of the Upper Marañon, and maintain them under their domination; a system somewhat more reasonable than that of making the natives of America speak Latin, as was gravely proposed in a provincial concilio at Mexico.

We were told that the Indians of the Cassiquiare and the Rio Negro are preferred on the Lower Orinoco, and especially at Angostura, to the inhabitants of the other missions, on account of their intelligence and activity. Those of Mandavaca are celebrated amung the tribes of their own race for the preparation of the curare poison, which does not yield in strength to the curare of Esmeralda. Unhappily the natives devote themselves to this employment more than to agriculture. Yet the soil on the banks of the Cassiquiare is excellent. We find there a granitic sand, of a blackish-brown colour, which is covered in the forests with thick layers of rich earth, and on the banks of the river with clay almost impermeable to water. The soil of the Cassiquiare appears more fertile than that of the valley of the Rio Negro, where maize does not prosper. Rice, beans, cotton, sugar, and indigo yield rich harvests, wherever their cultivation has been tried. $\ddagger$ We saw wild indigo around the missions of San Miguel de Davipe, San Carlos, and Mandavaca. No doubt can exist that several nations of America, particularly the Mexicans, long before the conquest, employed real indigo in their hieroglyphic

[^310]paintings; and that small caker of this substance were sold at the great market of Tenochtitlan. But a coloaring matter, chemically identical, may be extracted from plants belonging to neighbouring genera; and I should not at present venture to affirm that the native indigofere of America do not furnish some generic difference from the Indigofera anil, and the Indigofera argentea of the Old World. In the coffee-trees of both hemispheres this diffierence has been observed.
Here, as at the Rio Negro, the humidity of the air, and the consequent abundance of insects, are obstacles almost invincible to new cultivation. Everywhere you meet with those large ants that march in close bands, and direct their attacks the more readily on cultivated plants, because they are herbaceous and succulent, whilst the forests of these countries afford only plants with woody stalks. If a missionary wishes to cultirate salad, or any culinary plant of Europe, he is compelled as it were to suspend his garden in the air. He fills an old boat with good mould, and, having sown the seed, suspends it four feet above the ground with cords of the chiquichiqui palm-tree; but most frequently phaces it on a slight scaffolding. This protects the young plants from weeds, worms, and those ants which pursue their migration in a right line, and, not knowing what vegetates above them, seldom tarn from their course to climb up stakes that are stripped of their bark. I mention this circumstance to prove how difficalt, within the tropics, on the banks of great rivers, are the first attempts of man to appropriate to himself a little spot of earth in that vast doman of mature, invaded by amimals, and corered by spontaneous plants.

During the night of the 13th of May, I obtcined some obeerrations of the stars, umfortanately the last at the Cansiquiare. The latitude of Mandavaca is $2^{\circ} 4^{\circ} 7^{\prime \prime}$; its longitade, according to the chronometer, $69^{\circ} 27^{\circ}$. I found the magnetic dip $25^{\circ} 25^{\circ}$ (cent. div.), showing that it had increased considerably from the fort of San Carlos. Yet the surronnding rocks are of the same granite, mixed with a little hornblende, which we had found at Javita, and which assames a syenitic aspect. We left Mandaraca at hati-past two in the morning. After six hours' royage, we passed on
the enat the mouth of the Tdapa, or Siappa, which risom mon the mountain of Uuturan, and furnishes near its sources a portage to the Rio Mavaca, one of the tributary streame of the Orinoco. This river has white waters, and is not more than half as broad as the Pacimoni, the waters of which are black. Its upper course has been strangely miarepresented o maps. I shall have oceasion hereafter to mention the hypotheses that have given rise to these eurors, in speaking af the source of the Orinoeo.

We stopped near the raudal of Cunuri. The noise of the little cataract augmented sensibly during the night, and our Indians asserted that it was a certain presage of rain. I recollected that the mountaineers of the Alps have great confidence in the same prognostic.* It fell before sunrise; and the araguato monkeys had warned us, by their lengthened bowhings, of the approaching rain, long before the noise of the cataract increased.

On the 14th, the mosquitos, and especially the ants, drove us from the shore before two in the morning. We had hitherto been of opinion that the ants did not crawl along the cords by which the hammocks are usually suspended: whether we were correct in this supposition, or whether the ants fell on us from the tops of the trees, I cansot may; but certain it is that we had great difficulty to keep ourselves free from these troublesome insects. The river became narrower as we advanced, and the banks were so marshy, that it was not without much labour M. Bonpland could get to a Carolinea princeps loaded with large purplo fowers. This tree is the most besutiful ornament of these forests, and of those of the Rio Negro. We examined repeatedly, during this day, the temperature of the Camsi-

[^311]2 ㅍ 2
quiare. The water at the surface of the river was only $24^{\circ}$ (when the air was at $25 \cdot 6^{\circ}$ ). This is nearly the temperature of the Rio Negro, but four or five degrees below that of the Orinoco. After having passed on the west the mouth of the Caño Caterico, which has black waters of extraordinary transparency, we left the bed of the river, to land at an island on which the mission of Vasiva is established: The lake which surrounds this mission is a league broad, and communicates by three outlets with the Cassiquiare. The surrounding country abounds in marshes which generate fever. The lake, the waters of which appear yellow by transmitted light, is dry in the season of great heat, and the Indians themselves are unable to resist the miasmata rising from the mud. The complete absence of wind contributes to render the climate of this country more pernicious.

From the 14th to the 21st of May we slept constantly in the open air; but I cannot indicate the spots where we halted. These regions are so wild, and so little frequented, that with the exception of a few rivers, the Indians were ignorant of the names of all the objects which I set by the compass. No observation of a star helped me to fix the latitude within the space of a degree. After having passed the point where the Itinivini separates from the Cassiquiare, to take its course to the west towards the granitic hills of Daripabo, we found the marshy banks of the river covered with bamboos. These arborescent gramina rise to the height of twenty feet; their stem is constantly arched towards the summit. It is a new species of Bambusa with very broad leaves. M. Bonpland fortunately found one in flower; a circumstance I mention, because the genera Nastus and Bambusa had before been very imperfectly distinguished, and nothing is more rare in the New World, than to see these gigantic gramina in flower. M. Mutis herborised during twenty years in a country where the Bambusa guadua forms marshy forests several leagues broad, without having ever been able to procure the flowers. We sent that learned naturalist the first ears of Bambusa from the temperate vallies of Popayan. It is strange that the parts of fructification should develope themselves so rarely in a plant which is indigenous, and which vegetates with such extraordinary vigour, from the level of the sea to the height of nine hundred
toises, that is, to a subalpine region the climate of which, between the tropics, resembles that of the south of Spain. The Bambusa latifolia seems to be peculiar to the basins of the Upper Orinoco, the Cassiquiare, and the Amazon; it is a social plant, like all the gramina of the family of the nastoides; but in that part of Spanish Guiana which we traversed it does not grow in those large masses which the Spanish Americans call guadales, or forests of bamboos.

Our first resting-place above Vasiva was easily arranged. We found a little nook of dry ground, free from shrubs, to the south of the Caño Curamuni, in a spot where we saw some capuchin monkeys.* They were recognizable by theirblack beards and their gloomy and sullen air, and were walking slowly on the horizontal branches of a genipa. During the five following nights our passage was the more troublesome in proportion as we approached the bifurcation of the Orinoco. The luxuriance of the vegetation increases in a manner of which it is difficult even for those acquainted with the aspect of the forests between the tropics, to form an idea. There is no longer a bank : a palisade of tufted trees forms the margin of the river. You see a canal two hundred toises broad, bordered by two enormous walls, clothed with lianas and foliage. We often tried to land, but without success. Towards sunset we sailed along for an hour seeking to discover, not an opening (since none exists), but a spot less wooded, where our Indians by means of the hatchet and manual labour, could clear space enough for a resting-place for twelve or thirteen persons. It was impossible to pass the night in the canoe; the mosquitos, which tormented us during the day, accumulated toward evening beneath the toldo covered with palm-leaves, which served to shelter us from the rain. Our hands and faces had never before been so much swelled. Father Zea, who had till then boasted of having in his missions of the cataracts the largest and fiercest (las mas feroces) mosquitos, at length gradually acknowledged that the sting of the insects of the Cassiquiare was the most painful' he had ever felt. We experienced great difficulty, amid a thick forest, in finding wood to make a fire, the branches of the trees in

[^312]those equatorial regions where it always rains, being so full of sap, that they will scarcely burn. There being no bare shore, it is hardly possible to procure old wood, which the Indians call wood baked in the sut. However, fire was necessary to us only as a defence against the beasts of the forest; for we had such a scarcity of provision that we had little need of fuel for the purpose of preparing our food.

On the 18th of May, towards evening, we discovered a spot where wild cacao-trees were growing on the bank of the river. The nut of these cacaos is small and bitter; the Indians of the forest suck the pulp, and throw away the nut, which is picked up by the Indians of the missions, and sold to persons who are not very mice in the preparation of their chocolate. "This is the Puerto del Caces" (Cacao Port), said the pilot; "it is here our Padres sleep, when they go to Esmeralda to buy sarbacans* and jworias (Brazil nuts). Not five boats, however, pass annually by the Cassiquiare; and since we left Maypures (a whole month previously), we had not met one living soul on the rivers we navigated, except in the immediate neighbourhood of the missions. To the south of lake Duractumuni we slept in a forest of palm-trees. It rained violently, but the pothoses, arums, and lianas, furnished so thick a natural trellis, that we were sheltered wa under a vault of foliage. The Indians whose hammocks were placed on the edge of the river, interwove the heliconias and other musacess, so as to form a kind of roof over them. Our fires lighted up, to the height of fifty or sixty feet, the palm-trees, the lianas loaded with flowers, and the columns of white smoke, which ascended in a straight line toward the sky. The whole exhibited a magnificent spec tacle; but to have enjoyed it fully, we should have breathed an air clear of insects.

The most depressing of all physical sufferings are those which are uniform in their duration, and can be combated only by long patience. It is probable, that in the exhalations of the forests of the Cassiquiare M. Bonpland imbibed the seeds of a severe malady, under which he nearly sunk on our arrival at Angostura. Happily for him and for me, nothing led un to presage the danger with which he was

* The bamboo tubes furnished by the Arundinaria, used for projecting the poisoned arrows of the natives.-See Views of Nature, p. 180.
merraced. The view of the river, and the hum of the insects, were a little monotonous; but some remains of our natural cheerfutness enabled us to find sources of relief during our wearisome passage. We discovered, that by eating small portions of dry cacao ground without sugar, and drinking a large quantity of the river water, we succoeded in appeasing our appetite for several hours. The ants and the mosquitos troubled us more than the humidity and the want of food. Notwithstanding the privations to which we were exposed during our excursions in the Cordilleras, the navigation from Mandavaca to Esmeralda has always appeared to us the most painful part of our travels in America. I advise those who are not very desirous of seeing the great bifurcation of the Orinoco, to take the way of the Atabapo in preference to that of the Cassiquiare.

Above the Caño Duractumuni, the Cassiquiare parsues a mniform direction from north-east to south-west. We wers surprised to see how much the high steep banks of the Cassiquiare had been undermined on each side by the madden risings of the water. Uprooted trees formed as it were natural rafts; and being half-buried in the mud, they were extremely dangerous for canoes. We passed the night of the 20th of May, the last of our passage on the Cassiquiare, near the point of the bifurcation of the Orinoco. We had some hope of being able to make an astronomical observation, as falling-stars of remarkable magnitude were visible through the vapours that veiled the sky; whence we concluded that the stratum of vapours must be very thin, since meteors of this kind have scarcely ever been seen below a cloud. Those we now beheld shot towards the zorth, and succeeded each other at almost equal intervals. The Indians, who seldom ennoble by their expressions the wanderings of the imagination, name the falling-stars the arine; and the dew the opittle of the stars. The clouds thickened anew, and we discerned neither the meteor, nor the real stars, for which we had impatienly waited during several days.

We had been told, that we should find the insects at Fnemeralda "still more crisel and voracious," tham in the branch of the Orinoco which we were going up; nevertheless
we indulged the hope of at length sleeping in a spot that was inhabited, and of taking some exercise in herbalizing. This anticipation was, however, disturbed at our last restingplace on the Cassiquiare. Whilst we were sleeping on the edge of the forest, we were warned by the Indians, in the middle of the night, that they heard very near us the cries of a jaguar. These cries, they alleged, came from the top of some neighbouring trees. Such is the thickness of the forests in these regions, that scarcely any animals are to be found there but such as climb trees; as, for instance, the monkeys, animals of the weasel tribe, jaguars, and other species of the genus Felis.

As our fires burnt brightly, we paid little attention to the cries of the jaguars. They had been attracted by the smell and noise of our dog. This animal (which was of the mastiff breed) began at frst to bark; and when the tiger drew nearer, to howl, hiding himself below our hammocks. How great was our grief, when in the morning, at the moment of re-embarking, the Indians informed us that the dog had disappeared! There could be no doubt that it had been carried off by the jaguars.* Perhaps, when their cries had ceased, it had wandered from the fires on the side of the beach; and possibly we had not heard its moans, as we were in a profound sleep. We have often heard the inhabitants of the banks of the Orinoco and the Rio Magdalena affirm, that the oldest jaguars will carry off animals from the midst of a halting-place, cunningly grasping them by the neck so as to prevent their cries. We waited part of the morning, in the hope that our dog had only strayed. Three days after we came back to the same place; we heard again the cries of the jaguars, for these animals have a predilection for particular spots; but all our search was vain. The dog, which had accompanied us from Caracas, and had so often in swimming escaped the pursuit of the crocodiles, $\dagger$ had been devoured in the forest.

On the 2 lst May, we again entered the bed of the Orinoco, three leagues below the mission of Esmeralda. It was now a month since we had left that river near the mouth of the Guaviare. We had still to proceed seven

[^313]$\dagger$ Ibid., p. 198.
hundred and fifty miles* before reaching Angostura, but we should go with the stream ; and this consideration lessened our discouragement. In descending great rivers, the rowers take the middle of the current, where there are few mosquitos; but in ascending, they are obliged, in order to avail themselves of the dead waters and counter-currents, to sail near the shore, where the proximity of the forests, and the remains of organic substances accumulated on the beach, harbour the tipulary insects. The point of the celebrated bifurcation of the Orinoco has a very imposing aspect. Lofty granitic mountains rise on the northern bank; and amidst them are discovered at a distance the Maraguaca and the Duida. There are no mountains on the left bank of the Orinoco, west or east of the bifurcation, till opposite the mouth of the Tamatama. On that spot stands the rock Guaraco, which is said to throw out flames from time to time in the rainy season. When the Orinoco is no longer bounded by mountains towards the south, and when it reaches the opening of a valley, or rather a depression of the ground, which terminates at the Rio Negro, it divides itself into two branches. The principal branch (the Rio Paragua of the Indians) continues its course west-north-west, turning round the group of the mountains of Parime; the other branch forming the communication with the Amazon runs into plains, the general slope of which is southward, but of which the partial planes incline, in the Cassiquiare, to south-west, and in the basin of the Rio Negro, south-east. A phenomenon so strange in appearance, which I verified on the spot, merits particular attention; the more especially as it may throw some light on analogous facts, which are supposed to have been observed in the interior of Africa.

The existence of a communication of the Orinoco with the Amazon by the Rio Negro, and a bifurcation of the Caqueta, was believed by Sanson, and rejected by Father Fritz and by Blaeuw : it was marked in the first maps of De l'Isle, but abandoned by that celebrated geographer towards the end of his days. Those who had mistaken the mode of this communication hastened to deny the communication itself. It is in fact well worthy of remark that, at the time when the

* Of nine hundred and fifty toises each, or two hundred and fifty nautical leagues.

Portuguese went up most frequently by the Amanon, the Rio Negro, and the Cassiquiare, and when Father Gumilla's letters were carried (by the natural interbranching of the rivers) from the lower Orinoco to Grand Para, that very missionary made every effort to spread the opinion through Warope that the basins of the Orinoco and the Amazon are perfectly separate. He asserts that, having several times gome up the former of these rivers as far as the Raudal of Tabaje, situate in the tatitude of $1^{\circ} 4^{\prime}$, he never saw a river How in or out that could be taken for the Rio Negro. He adds further, that "a great Cordillera, which stretehee from east to west, prevents the mingling of the waters, and renders all discussion on the supposed communication of the two rivers useless." The errors of Father Gumills anose from his firm persuasion that he had reached the parallea of $1^{\circ} 4^{\prime}$ or the Orinoco. He was in error by more than $5^{\circ} 10^{\circ}$ of latitude; for I found, by observation, at the mission of Atures, thirteen leagues south of the rapids of Tabaje, the latitude to be $5^{\circ} 37^{\prime} 34^{\prime \prime}$. Gumilla having gone but little above the confluence of the Meta, it is not aurprising that he had no knowledge of the bifurcation of the Orinoce, which is found by the sinuosities of the river to be one hundred and twenty leagaes distant from the Revadal of Tabaje.

La Condanine, during his memorable navigation on the river Amazon in 1748, carefully collected a great number of proofs of this communication of the rivers, denied by the Epanish Jesuit. The most decisive proof then appeared to tum to be the unsuspected teatimony of a Cauriacani Indian woman with whom he had conversed, and who had come in a boat from the banks of the Orinoco (from the mission of Pararuma) to Grand Para. Before the retarn of La Condamine to his own country, the voyage of Father Manuel Roman, and the fortuitous meeting of the missionaries of the Orinoco and the Amazon, left no doubt of this fact, the knowledge of which was first obtained by Acunha.

The incursions undertaken from the middle of the seventoenth century, to procure slaves, had gradually led the Portuguese from the Rio Negro, by the Cassiquiare, to the bed of a great river, which they did not know to be the Upper Orinoco. A flying camp, composed of the troop of
ransomers,* favoured this inhaman commerce. After having excited the natives to make war, they ransomed the priconers; and, to give an appearance of equity to the traffe, monks accompanied the troop of ransomers to examine "whether those who sold the slaves had a right to do so, by having made them prisoners in open war." From the yesp 3787 these visits of the Portaguese to the Upper Orinoce beeame very frequent. The desire of exchanging slaves (poitos) for hatchets, fish-hooks, and glass trinkets, induced the Indian tribes to make war upon one another. The Guipumaves, led oa by their valiant and cruel chief Macapu, dercended from the banks of the Inirida towards the confluerce of the Atabapo and the Orinoco. "They sold," says the missionary Gili, "the slaves whom they did not eat." 4 The Jesuits of the Lower Orinoco became unency at this state of things, and the superior of the Spanish missions, Father Roman, the intimate friend of Gumilla, took the courageous resolution of crossing the Great Cataracts, and visiting the Guipunaves, without being eacorted by Spanish soldiers. He left Carichana the 4th of Februsty, 1744; and having arrived at the confluence of the Guaviare, the Atabapo, and the Orinoco, where the last mentioned river suddenly changes its previoas course from east to west, to a direction from south to north, he saw from afar a canoe as large as his own, and filled with men in Ehnopean dresses. He caused a crucifix to be placed at the bow of his boat in sign of peace, according to the custom of the missionaries when they navigate in a country unknowa to them. The whites, who were Portuguese slave-traders of the Bio Negro, recognized with marks of joy the habit of the order of St. Ignatius. They heard with astonishment that the river on which this meeting took place was the Orinoco; and they brought Father Roman by the Cassiquiare to the Brazilian settlements on the Rio Negro. The

[^314]superior of the Spanish missions was forced to remain near the flying camp of the troop of ransomers till the arrival of the Portuguese Jesuit Avogadri, who had gone upon business to Grand Para. Father Manuel Roman returned with his Salive Indians by the same way, that of the Cassiquiare and the Upper Orinoco, to Pararuma," a little to the north of Carichana, after an absence of seven months. He was the first white man who went from the Rio Negro, consequently from the basin of the Amazon, without passing his boats over any portage, to the basin of the Lower Orinoco.

The tidings of this extraordinary passage spread with such rapidity that La Condamine was able to announce it $\dagger$ at a public sitting of the Academy, seven months after the return of Father Roman to Pararuma. "The communication between the Orinoco and the Amazon," said he, "recently averred, may pass so much the more for a discovery in geography, as, although the junction of these two rivers is marked on the old maps (according to the information given by Acunha), it had been suppressed by all the modern geographers in their new maps, as if in concert. This is not the first time that what is positive fact has been thought fabulous, that the spirit of criticism has been pushed too far, and that this communication has been treated as chimerical by those who ought to have been better informed." Since the voyage of Father Roman in 1774, no person in Spanish Guiana, or on the coasts of Cumana and Caracas, has admitted a doubt of the existence of the Cassiquiare and the bifurcation of the

[^315]Orinoco. Father Gumilla himself, whom Bouguer met at Carthagena, confessed that he had been deceived; and he read to Father Gili, a short time before his death, a supplement to his history of the Orinoco, intended for a new edition, in which he recounts pleasantly the manner in which he had been undeceived. The expedition of the boundaries, under Iturriaga and Solano, completed in detail the knowledge of the geography of the Upper Orinoco, and the intertwinings of this river with the Rio Negro. Solano established himself in 1756 at the confluence of the Atabapo; and from that time the Spanish and Portuguese commissioners often passed in their canoes, by the Cassiquiare, from the Lower Orinoco to the Rio Negro, to visit each other at their head-quarters of Cabruta* and Mariva. Since the year 1767, two or three canoes come annually from the fort of San Carlos; by the bifurcation of the Orinoco to Angostura, to fetch salt and the pay of the troops. These passages, from one basin of a river to another, by the natural canal of the Cassiquiare, excite no more attention in the colonists at present than the arrival of boats that descend the Loire by the canal of Orleans, awakens on the banks of the Seine.

Although, since the journey of Father Roman, in 1744, precise notions have been acquired in the Spanish possessions in America, both of the direction of the Upper Orinoco from east to west, and of the manner of its communication with the Rio Negro, this knowledge did not reach Europe till a much later period. In 1750, La Condamine and D'Anville $\dagger$ were still of opinion that the Orinoco was a

- General Iturriaga, confined by illness, first at Muitaco, or Real Corona, and afterward at Cabruta, received a visit in 1760 from the Portuguese colonel Don Gabriel de Souza y Figueira. who came from Grand Para, having made a voyage of nearly nine hundred leagues in his boat. The Swedish botanist, Loefling, who was chosen to accompany the expedition of the boundaries at the expense of the Spanish government, so greatly multiplied in his ardent imagination the branchings of the great rivers of South America, that he appeared well persuaded of being able to navigate, by the Rio Negro and the Amazon, to the Rio de la Plata. (Iter, p. 131.)
$\dagger$ See the classical memoir of this great geographer in the Journal des Savans, March 1750, p. 184. "One fact," says D'Anville, "which cannot be considered as equivocal, after the proofs with which we have been
lwasel of the Caquete eoming from the south-oast, and thett the Rio Negro issued immediately from it. It was only in the second edition of his South America, that D'Anville (without renouncing that intercommunication of the Caqueta, by means of the Inirichs (Inirida), with the Orinoco and the Rio Negro) describes the Orinoco as taking its rise at the east, near the source of the Rio Branco, and marks the Bio Cassiquiare as bearing the waters of the Upper Orimoco to the Rio Negre. It is probable that this indefatigable and learned wriker had obtained information on the manner of the bifurcation from his frequent communications with the missionaries," who were then the only geographers of the most inland parts of the continents.

Had the nations of the lower region of equinoctial America participated in the civilization spread over the cold and alpine region, that immense Mesopotsmia between the Orinoco and the Amazon would bave favoured the development of their industry, animated their commerce, and accelerated the progress of social order. We see everywhere in the old world the influence of loeality on the dewning civilization of nations. The island of Meroe betweea the Astaboras and the Nile, the Punjab of the Indus, the Dousb of the Ganger, and the Mesopotamia of the Euphrates, furnish examples that are justly celebrated in the annols of the human race. But the feeble tribes that wander in the savamahs and the woods of eastern America, have profited little by the advantages of their soil, and the interbramchings of their rivers. The distant incursions of the Caribs, who went up the Orinoeo, the Cassiquiare, and the recently furnished, is the communication of the Rio Negro with the Orimoco; but we mast not besitate to admit, thut we aro not yet snfficiently informed of the manner in which this commanication takseo place." I wan surprised to see in a very rare map, which I found at Reme (Provincia Quitensias Soc. Jesu in America, auctore Carolo Brentano ot Nicoleo de la Torre; Romex, 1745), that seven years after the discomery of Father Romsan, the Jemits of Quito were igmorant of the existence of the Cassiquiare. The Rio Negro is figared in this map as a branch of the Orinoco.

- According to the Annals of Berroie, it would appear, that as earis as the year 1739, the military incursions from the Rio Negro to the Cassiquiare had confirmed the Portuguese Jesnits in the opinion that there was a communication betrees the Amason and the Orimocon Somalhey's Braxife, vol. i, p. 658.

Rio Negro, to carry of slaves and exercise pillage, compellod some rude tribes to rouse themselven frome, their indolence, and form associations for their common defence; the little good, however, which these wars with the Caribs (the Bedouins of the rivers of Guiana) produced, was but slight compensation for the evils that followed in their train, by rendering the tribes more ferocious, and diminishing their population. We cannot doubt, that the physical aspect of Greece, intorsected by small chains of mountains, and mediterranean gulfs, contributed, at the dawn of civilization, to the intellectual development of the Greeks. But the operation of this influence of climate, and of the configuration of the soil, is felt in all its force only among a race of men who, endowed with a happy organization of the mental faculties, are susceptible of exterior impulse. In studying the history of our species, we see, at certain distances, these foci of ancient civilization dispersed over the globe hike luminous points; and we are struck by the inequality of improvement in nations inhabiting analogous climates, and whose native soil appears equally favoured by the most precious gifts of nature.

Since my departure from the banks of the Orinoco and the Amazon, a new era has unfolded itself in the social state of the mations of the West. The fury of civil disscusions has been succeeded by the blessings of peace, and a freer development of the arts of industry. The bifurcations of the Orinoco, the isthmus of Tuamini, so easy to be made passable by an artificial canal, will ere long fix the attention of commercial Europe. The Cassiquiare, as broad as the Rhine, and the course of which is one hundred and eighty miles in length, will no longer form uselessly a navigable camal between two basins of rivers which have a surface of one hundred and minety thousand square leagues. The grain of: New Grenads will be carried to the banks of the Rio Negro boats will descend from the sources of the Napo and the Ucuyabe, from the Andes of Quito and of Upper Peru, to the mouths of the Orinoco, a distance which equals that from Timbuctoo to Marseilles. A country nine or ten times larger than Spain, and enriched with the most varied productions, is narigable in every direction by the medium of the natural canal of the Cassiquiare, and the bifurcation
of the rivers. This phenomenon, which will one day be so important for the political connections of nations, unquestionably deserves to be carefully examined.

## Chapter XXIV.

The Upper Orinoco, from Esmeralda to the confluence of the Guaviare. Second passage across the Cataracts of Atures and Maypures.-The Lower Orinoco, between the mouth of the Rio Apure, and Angostura the capital of Spanish Guiana.

Opposite to the point where the Orinoco forms its bifurcation, the granitic group of Duida rises in an amphitheatre on the right bank of the river. This mountain, which the missionaries call a volcano, is nearly eight thousand feet high. It is perpendicular on the south and west, and has an aspect of solemn grandeur. Its summit is bare and stony, but, wherever its less steep declivities are covered with mould vast forests appear suspended on its flanks. At the foot of Duida is the mission of Esmeralda, a little hamlet with eighty inhabitants, surrounded by a lovely plain, intersected by rills of black but limpid water. This plain is adorned with clumps of the mauritia palm, the sago-. tree of America. Nearer the mountain, the distance of which from the cross of the mission I found to be seven thousand three hundred toises, the marshy plain changes to a savannah, and spends itself along the lower region of the Cordillera. Large pine-apples are there found of a delicious flavour; that species of bromelia always grows solitary among the gramina, like our Colchicum autumnale, while the B. karatas, another species of the same genus, is a social plant, like our whortleberries and heaths. The pine-apples of Esmeralda are cultivated throughout Guiana. There are certain spots in America, as in Europe, where different fruits attain their highest perfection. The sapota-plum (achra) should be eaten at the Island of Margareta or at Cumana: the chirimoya (very different from the custardapple and sweet-sop of the West India Islands) at Loxa in Peru; the grenadilla, or parcha, at Caracas; and the pineapple at Esmeralda, or in the island of Cuba. The pino-
apple forms the ornament of the fields near the Havannah, where it is planted in parallel rows; on the sides of the Duida it embellishes the turf of the savannahs, lifting its yellow fruit, crowned with a tuft of silvery leaves, above the setaria, the paspalum, and a few cyperacem. This plant, which the Indians of the Orinoco call ana-curua, has been propagated since the sixteenth century in the interior of China,* and some English travellers found it recently, together with other plants indubitably American (maize, cassava, tobacco, and pimento), on the banks of the River Congo, in Africa.

There is no missionary at Esmeralda; the monk appointed to celebrate mass in that hamlet is settled at Santa Barbara, more than fifty leagues distant; and he visits this spot but five or six times in a year. We were cordially received by an old officer, who took us for Catalonian shopkeepers, and who supposed that trade had led to the missions. On seeing packages of paper intended for drying our plants, he smiled at our simple ignorance. "You come," said he, "to a country where this kind of merchandise has no sale; we write little here; and the dried leaves of maize, the platano (plantaintree), and the vijaho (heliconia), serve us, like paper in Europe, to wrap up needles, fish-hooks, and other little articles of which we are careful." This old officer united in his person the civil and ecclesiastical authority. He taught the children, I will not say the Catechism, but the Rosary; he rang the bells to amuse himself; and impelled by ardent zeal for the service of the church, he sometimes used his chorister's wand in a manner not very agreeable to the natives.

Notwithstanding the small extent of the mission, three Indian languages are spoken at Esmeralda; the Idapimanare, the Catarapenno, and the Maquiritan. The last of these prevails on the Upper Orinoco, from the confluence of

* No doubt remains of the American origin of the Bromelia ananas. See Cayley's Life of Raleigh, vol. i, p. 61. Gili, vol. i, p. 210, 336. Robert Brown, Geogr. Observ. on the Plants of the River Congo, 1818, p. 50.
$\dagger$ The Arivirianos of the banks of the Ventuari speak a dialect of the language of the Maquiritares. The latter live, jointly with a tribe of the Macos, in the savannahs that are by the Padamo. They are so numerous, that they have even given their name to this tributary stream of the Orinoco.

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the Ventuari as far as that of the Padamo; the Caribbee prevails on the Lower Orinoco; the Ottomac, near the confluence of the Apure, at the Great Cataracts; and the Maravitan, on the banks of the Bio Negro. These are the five or six languages most generally spoken. We were surprised to find at Esmeralda many zambos, mulattos, and copper-coloured people, who called themselves Spaniards (Españoles) and who fancy they are white, because they are not so red as the Indians. These people live in the most absolute misery; they have for the most part been sent hither in banishment (desterrados). Solano, in his haste to found colonies in the interior of the country, in order to guard its entrance against the Portuguese, assembled in the Llanos, and as far as the island of Margareta, vagabonds and malefactors, whom justice had vainly pursued, and made them go up the Orinoco to join the unhappy Indians who had been carried off from the woods. A mineralogical error gave celebrity to Esmeralda. The granites of Duida and Maraguaca contain in open veins fine rock-crystals, some of them of great transparency, others coloured by chlorite or blended with aetonite ; these were mistaken for diamonds and emeralds.

So near the sources of the Orinoco we heard of nothing in these mountains but the proximity of El Dorado, the lake Parima, and the ruins of the great city of Manos. A man, still known in the country for his credulity and his love of exaggeration, Don Apollinario Diez de la Fuente, assumed the pompous title of capitan poblador, and cabo militar (military commander) of the fort of Cassiquiare. This fort consisted of a few.trunks of trees, joined together by planks; and to complete the deception, a demand was made at Madrid for the privileges of a villa for the mission of Esmersida, which but a hamlet with twelve or fifteen huts. A colony composed of elements altogether heterogeneous perished by degrees. The vagabonds of the Llanos had as little taste for labour as the natives, who were compelled to live "within the sound of the bell:" The former found a motive in their pride to justify their indolence. In the missions, every mulatto who is not decidedly black as an African, or copper-coloured as an Indian, calls himself a Spaniard; he belongs to the gente do razon,-the sace endued with reason; and that reason (sometimes, it must be admitted, arrogant and indolent).
persuaded the whites, and those who fancy they are so, that to till the ground is a task fit only for slaves (poitos) and the native neophytes. The colony of Esmeralda had been founded on the principles of that of Australia; but it was far from being governed with the same wisdom. The American colonists, being separated from their native soil, not by seas, but by forests and savannahs, dispersed; some taking the road northward, towards the Caura and the Carony; others proceeding southward to the Portuguese possessions. Thas the celebrity of this villa, and of the emerald-mines of Duida, vanished in a few years; and Esnaeralda, on account of the immense number of insects that obseure the air at all seasons of the year, was regarded by the manks as a place of banishment. The superior of the missions, when he would make the lay-brothers mindful of their duty, threatens sometimes to send them to Esmeralda; "that is," say the monks, "to be condemned to the mosquitos; to be devoured by there buzzing flies (zancudos gritones), which God appears to have created for the torment and chastisement of man."." These strange punishments have not always been confined to the lay-brothers. There happened in 1788 one of those monastic revolutions, of which it is difficult to form a conception in Europe, according to the ideas that prevail of the peaceful state of the Christian settlements in the New World. For a long period the Franciscan monks settled in Guiana had been desirous of forming a separate republie, and rendering themselves indopendent of the college of Piritu at Nueva Barcelona. Discontented with the election of Fray Gutierez de Aguilera, chosen by a general chapter, and confirmed by the king in the important office of president of the missions, five or six monks of the Upper Orinoco, the Cassiquiare, and the Rio Negro, assembled together at San Fernando de Atabapo; chose hastily a new superior from their own body; and caused the old one, who, unfortunately for himself, had come to risit those parts, to be arrested. They put him in irons, threw him into a boat, and conducted him to Esmeralda, as

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to a place of proscription. This great distance of the coast from the scene of this revolution led the monks to hope that their crime would remain long unknown beyond the Great Cataracts. They wished to gain time to intrigue, to negotiate, to frame acts of accusation, and employ the little artifices by which, in every country, the invalidity of a first election may be proved. Fray Gutierez de Aguilera languished in his prison at Esmeralda, and fell dangerously ill from the double influence of the excessive heat, and the continual irritation of the mosquitos. Happily for the fallen power the monks did not remain united. A missionary of the Cassiquiare conceived serious alarms respecting the issue of this affair; he dreaded being sent a prisoner to Cadiz, or, as they say in the colonies, having his name on the list (baxo partido de registro). Fear overcame his resolution, and he suddenly disappeared. Indians were placed on the watch at the mouth of the Atabapo, at the Great Cataracts, and wherever the fugitive was likely to pass on his way to the Lower Orinoco. Notwithstanding these precautions, he arrived at Angostura, and then reached the college of the missions of Piritu; denounced his colleagues; and was appointed, in recompense of this information, to arrest those with whom he had conspired against the president of the missions." At Esmeralda, where the political events that have agitated Europe for thirty years past have not yet been heard of, lively interest is still felt in an event which is called "the sedition of the monks," (el alboroto de los frailes.) In this country, as in the East, no conception is formed of any other revolutions than those that are made by rulers themselves; and we have just seen that the effects are not very alarming.

If the villa of Esmeralda, with a population of twelve or fifteen families, be at present considered as a frightful place of abode, this must be attributed to the want of cultivation, the distance from every other inhabited country, and the exces-

* Two of the missionaries, considered as the leaders of the insurrection, were embarked at Angostura, in order to be tried in Spain. The vessel in which they were conveyed became leaky, and put into Spanish Harbour in the island of Trinidad. The governor Chacon intereated himself in the fate of the monks; they were pardcned a violent proceeding somewhat inconsistent with monastic discipline, and were again employed in the missions. I wasacquainted with them both during my abode in South America,
sive quantity of mosquitos. The site of the mission is highly picturesque; the surrounding country is lovely, and of great fertility. I never saw plantains of so large a size as these; and indigo, sugar, and cacao might be produced in abundance, if any trouble were taken for their cultivation. The Cerro Duida is surrounded with fine pasturage; and if the Observantins of the college of Piritu partook a little of the industry of the Catalonian Capuchins settled on the banks of the Carony, numerous herds would be seen wandering between the Cunucunumo and the Padamo. At present, not a cow or a horse is to be found; and the inhabitants, victims of their own indolence, are often reduced to eat the flesh of alouate monkeys, and flour made from the bones of fish, of which I shall have occasion to speak hereafter. A little cassava and a few plantains only are cultivated; and when the fishery is not abundant, the natives of a country so favoured by nature are exposed to the most cruel privations.

The pilots of the small number of boats that go from the Rio Negro to Angostura by the Cassiquiare are afraid to ascend as far as Esmeralda, and therefore that mission would. have been much better placed at the point of the bifurcation of the Orinoco. It is probable, that this vast country will not always be doomed to the desertion in which it has hitherto been left, owing to the errors of monkish administration and the spirit of monopoly that characterises corporations. We may even predict on what points of the Orinoco industry and commerce will become most active. In every zone, population is concentred at the mouth of tributary streams. The Rio Apure, by which the productions of the provinces of Varinas and Merida are exported, will give great importance to the little town of Cabruta, which will then be in rivalship with San Fernando de Apure, where all commerce has hitherto centred. Higher up, a new settlement will be formed at the confluence of the Meta, which communicates with New Grenada by the Llanos of Casanare. The two missions of the Cataracts will increase, from the activity to which the transport of boats at those points will give rise; for an unhealthy and damp climate, and the swarming of mosquitos, will as little impede the progress of cultivation at the Orinoco as at the Rio Magdalena, whenever a powerful mercantile
interest shall call new settlers thifher. Habitual evils ane those which are least felt; and men born in Amorica do not suffer the same intensity of pain as Europeams recembly arrived. Perhaps, also, the destruction of forests momad the inhabited places, although slow, will nomewhat tend to diminish the torment of the tipulary insects. Slam Fernando de Atabapo, Javita, San Carlos, and Esmoralda; appear (from their situation at the mouth of the Guaviare, the portage between Tuamini and the Rio Negro, the confluence of the Cassiquiare, and the point of bifurcation of the Upper. Orinooo) to promise a considerable increase of population and prosperity. The same improvement wid take place in the fertile but uncultivated countries thronagh which flow the Guallaga, the Amazon, and the Orinaco; as well as at the isthmus of Panama, the lake of Nicaragras, and the Rio Huasacualoa, which farnish a commaniention between the two oceans. The imperfection of political institutions may for ages have converted into deserts places where the commeroe of the world should be found comcentred; but the time approaches when these obstacles will exist no longer. A vicious administration cannot always struggle against the united interest of men; and civilization will be carried insensibly into those countries, the great destinies of which nature itself proclaims, by the physical configuration of the soil, the immense windings of the rivers, and the proximity of two seas, that bathe the shores of Europe and of India.

Esmeralda is the most celebrated spot on the Orinoee for the preparation of that active poison, which is employed in war, in the chase, and, singularly enough, as a remedy for gastric derangements. The poison of the ticunas of the Amazon, the upas-tieute of Java, and the currare of Guiama, are the most deleterious substances that are known. Raleigh, about the end of the sixteenth century, had heard of urari* as being a vegetable substance with which arrows were envenomed; yet no fixed notions of this poison had neached Europe. The missionaries Gumilla and Gili had not been able to penetrate into the country where the ourare is manufactured. Gumilla asserts that "this pero-

[^317]paration was enveloped in great mystery; that its principad mogredient was furnished by a subterranean plant with a taberous root, which never puts forth leaves, and which is called specially 'the root' (raiz de si misma) ; that the venomous exhalations which arise from the manufacture are fatal to the lives of the old women who (being otherwise useless) are chosen to watch over this operation; finally, that these vegetable juices are never thought to be sufficiently concentrated till a few drops produce at a distance a repulsive action on the blood. An Indian wounds himself slightly; and a dart dipped in the liquid curare is held near the wound. If it make the blood return to the vessels without having been brought into contact with them, the poison is judged to be sufficiently concentrated."

When we arrived at Esmeralda, the greater part of the Indians were returning from an excursion which they had made to the east, beyond the Rio Padamo, to gather juvias, or the fruit of the bertholletia, and the liana which yields the curare. Their return was celebrated by a festival, which is called in the mission la fiesta de las juvias, and which resembles our harrest-homes and vintage-feasts. The women had prepared a quantity of fermented liquor; and during two days the Indians were in a state of intoxication. Among nations who attach great importance to the fruit of the palm, and of some other trees useful for the nourishment of man, the period when these fruits are gathered is marked by public rejoicings, and time is divided according to these festivals, which succeed one another in a course invariably regular. We were fortunate enough to find an old Indian more temperate than the rest, who was employed in preparing the curare poison from freshlygathered plants. He was the chemist of the place. We found at his dwelling large earthen pots for boiling the vegetable juice, shallower vessels to favour the evaporation by a larger surface, and leaves of the plantain-tree rolled ap in the shape of our filters, and used to filtrate the liquids, more or less loaded with fibrous matter. The greatest order and neatness prevailed in this hut, which was trasefarmed into a chemical laboratory. The old Indian was known throughoat the mission by the name of the poisonmaster (amo del curare). He had that self-sufficient air
and tone of pedantry of which the pharmacopolists of Europe were formerly accused. "I know," said he, "that the whites have the secret of making soap, and manufacturing that black powder which has the defect of making a noise when used in killing animals. The curare, which we prepare from father to son, is superior to anything you can make down yonder (beyond sea). It is the juice of an herb which kills silently, without any one knowing whence the stroke comes."

This chemical operation, to which the old man attached so much importance, appeared to us extremely simple. The liana (bejuco) used at Esmeralda for the preparation of the poison, bears the same name as in the forests of Javita. It is the bejuco de Mavacure, which is gathered in abundance east of the mission, on the left bank of the Orinoco, beyond the Rio Amaguaca, in the mountainous and rocky tracts of Guanaya and Yumariquin. Although the bundles of bejuco which we found in the hut of the Indian were entirely bare of leaves, we had no doubt of their being produced by the same plant of the strychnos family (nearly allied to the rouhamon of Aublet) which we had examined in the forest of Pimichin.* The mavacure is employed fresh or dried indifferently during several weeks. The juice of the liana, when it has been recently gathered, is not regarded as poisonous; possibly it is so only when strongly concentrated. It is the bark and a part of the alburnum which contain this terrible poison. Branches of the mavacure four or five lines in diameter are scraped with a knife, and the bark that comes off is bruised, and reduced into very thin filaments on the stone employed for grinding cassava. The venemous juice being yellow, the whole fibrous mass takes that colour. It is thrown into a funnel nine inches

[^318]high, with an opening four inches wide. This funnel was of all the instruments of the Indian laboratory that of which the poison-master seemed to be most proud. He asked us repeatedly if, por alla (out yonder, meaning in Europe), we had ever seen anything to be compared to this funnel (embudo). It was a leaf of the plantain-tree rolled up in the form of a cone, and placed within another stronger cone made of the leaves of the palm-tree. The whole of this apparatus was supported by slight frame-work made of the petioles and ribs of palm-leaves. A cold infusion is first prepared by pouring water on the fibrous matter which is the ground bark of the mavacure. A yellowish water filters during several hours, drop by drop, through the leafy funnel. This filtered water is the poisonous liquor, but it acquires strength only when concentrated by evaporation, like molasses, in a large earthen pot. The Indian from time to time invited us to taste the liquid; its taste, more or less bitter, decides when the concentration by fire has been carried sufficiently far. There is no danger in tasting it, the curare being deleterious only when it comes into immediate contact with the blood. The vapours, therefore, which are disengaged from the pans are not hurtful, notwithstanding all that has been asserted on this point by the missionaries of the Orinoco. Fontana, in his experiments on the poison of the ticuna of the Amazon, long since proved that the vapours arising from this poison, when thrown on burning charcoal, may be inhaled without danger; and that the statement of La Condamine, that Indian women, when condemned to death, have been killed by the vapours of the poison of the ticuna, is incorrect.

The most concentrated juice of the mavacure is not thick enough to stick to the darts; and therefore, to give a body to the poison, another vegetable juice, extremely glutinous, drawn from a tree with large leaves, called kiracaguero, is poured into the concentrated infusion. As this tree grows at a great distance from Esmeralda, and was at that period as destitute of flowers and fruits as the bejuco de mavacure, we could not determine it botanically. I have several times mentioned that kind of fatality which withholds the most interesting plants from the examination of travellers, while thousands of others, of the chemical properties of which we
are ignorsent, are found loaded with flowers and faraits. Is travelling rapidly, even within the tropics, whene the flowering of the ligneous plants is of such long duration, scarcely one-eighth of the trees can be seen furnishing the essential parts of fructification. The chances of being able to determine, I do not say the family, but the genus and species, is consequently as one to eight; and it may be conceived that this unfavourable chance is felt most powerfully when it deprives us of the intimate knowledge of objects which afford a higher interest than that of descriptive botany.

At the instant when the glutinous juice of the kiracar guero-tree is poured into the venomous liquor well concentarted, and kept in a state of ebullition, it blackens, and coagulates inte a mass of the consistence of tar, or of a thick syrup. This mass is the curare of commerce. When we hear the Indians say that the kiracaquero is as necessany as the bejuco de mavacure in the manufacture of the poison, we may be led into error by the supposition that the former also contains some deleterious principle, while it onity serves (as the algarrobo, or any other gummy substance would do) to give more body to the concentrated juioe of the curare. The change of colour which the mixture undergoes is owing to the decomposition of a hydruret of carbon; the hydrogen is burned, and the carbon is set free. The curare is sold in little calabashes; but its preparation being in the hands of a few families, and the quantity of poison attached to each dart being extremely small, the best curvare, that of Esmoralda and Mandavaca, is sold at a very high priee. This substance, when dried, resembles opiam; but it strongly absorbs moisture when exposed to the air. Its taste is an agreeable bitter, and M. Bonpland and myself have often swallowed small portions of it. There is no danger in so doing, if it be certain that neither lips nor gums bleed. In experiments made by Mangili on the venom of the viper, one of his assistants swallowed all the poison that could be extracted from four large vipers of Italy, without being affected by it. The Indians consider the curare, taken internally, as an excellent stomachic. The same poison prepared by the Riraoas and Salives, though it has some eelebrity, is not so anuch entoemed as that of Eimeralda The process of this preparation appears to be everywheme
nearly the same; but there is no proof that the different poisons sold by the same name at the Orinooo and the Amazon are identical, and derived from the same plants. Orfila, therefore, in his excellent work On Poisons, has wery judiciously separated the wourali of Dutch Guiama, the curare of the Orinoco, the ticuna of the Amazon, and all those substances which have been too vaguely united under the name of 'American poisons.' Possibly at some future day, one and the same alkaline principle, similar to morphine and strychnia, will be found in poisonous plants belonging to different genera.

At the Orinaco the ourare de raiz (of the root) is distinguished from the curare de bejuco (of lianas, or of the bark of branches). We saw only the latter prepared; the former is weaker, and much less esteemed. At the river Amazon we learned to distinguish the poisons of the Ticuna, Yagaa, Peva, and Xibaro Indians, which being all obtained from the same plant, perhaps differ only by a more or less careful preparation. The Ticuna poison, to which La Condamine has given so much celebrity in Europe, and which somewhat improperly begins to bear the name of ticuna, is extracted from a liana which grows in the island of Mormorote, on the Upper Marañon. This poison is employed partly by the Ticunas, whe remain independent on the Spanish territory near the sources of the Yacarique; and partly by Indians of the same tribe, inhabiting the Partuguese mission of Loreto. The poisons we have just named differ totally from that of La Peca, and from the poison of Lamas and of Moyobamba. I enter into these details because the vestiges of plants which we were able to examine, proved to us (contrary to the common opinion) that the three poisons of the Ticunas, of La Peca, and of Moyobamba are not obtained from the same species, probably not even from congeneric plants. In proportion as the preparation of the curare is simple, that of the poison of Moyobamba is a long and complicated process. With the juice of the bejuco de ambihuasca, which is the principal ingredient, are mixed pimento, tobacco, barbasco (Jacquinia armillaris), sanango (Tabernæ montana), and the milk of some other apocynem. The fresh juice of the ambihuasca has a deleterious action when in contact with the blood; the juice of the
mavacure is a mortal poison only when it is concentrated by fire ; and ebullition deprives the juice of the root of Jatropha manihot (the manioc) of all its baneful qualities. In rubbing a long time between my fingers the liana which yields the potent poison of La Peca, when the weather was excessively hot, my hands were benumbed; and a person who was employed with me felt the same effects from this rapid absorption by the uninjured integuments.

I shall not here enter into any detail on the physiological properties of those poisons of the New World which kill with the same promptitude as the strychnem of Asia,* but without producing vomiting when they are received into the stomach, and without denoting the approach of death by the violent excitement of the spinal marrow. Scarcely a fowl is eaten on the banks of the Orinoco which has not been killed with a poisoned arrow; and the missionaries allege that the flesh of animals is never so good as when this method is employed. Father Zea, who accompanied us, though ill of a tertian fever, every morning had the live fowls allotted for our food brought to his hammock together with an arrow, and he killed them himself; for he would not confide this operation, to which he attached great importance, to any other person. Large birds, a guan (pava de monte) for instance, or a curassao (alector), when wounded in the thigh, die in two or three minutes; but it is often ten or twelve minutes before life is extinct in a pig or a peccary. M. Bonpland found that the same poison, bought in different villages, varied much. We had procured at the river Amazon some real Ticuna poison which was less potent than any of the varieties of the curare of the Orinoco. Travellers, on arriving in the missions, frequently testify their apprehension on learning that the fowls, monkeys, guanas, and even the fish which they eat, have been killed with poisoned arrows. But these fears are groundless. Majendie has proved by his ingenious experiments on transfusion, that the blood of animals on which the bitter strychnos of India has produced a deleterious effect, has no fatal action on other animals. A dog received a considerable quantity of poisoned blood into his veins without any trace of irritation being perceived in the spinal marrow.

[^319]I placed the most active curare in contact with the crural nerves of a frog, without perceiving any sensible change in measuring the degree of irritability of the organs, by means of an arc formed of heterogeneous metals. Galvanic experiments succeeded upon birds, some minutes after I had killed them with a poisoned arrow. These observations are not uninteresting, when we recollect that a solution of the upaspoison poured upon the sciatic nerve, or insinuated into the texture of the nerve, produces also a sensible effect on the irritability of the organs by immediate contact with the medullary substance. The danger of the curare, as of most of the other strychnem, (for we continue to believe that the mavacure belongs to a neighbouring family,) results only from the action of the poison on the vascular system. At Maypures, a zambo descended from an Indian and a negro, prepared for M. Bonpland some of those poisoned arrows, that are shot from blowing-tubes to kill small monkeys or birds. He was a man of remarkable muscular strength. Having had the imprudence to rub the curare between his fingers after being slightly wounded, he fell on the ground seized with a vertigo, that lasted nearly half an hour. Happily the poison was of that diluted kind which is used for very small animals, that is, for those which it is believed can be recalled to life by putting muriate of soda into the wound. During our passage in returning from Esmeralda to Atures, I myself narrowly escaped an imminent danger. The curare, having imbibed the humidity of the air, had become fluid, and was spilt from an imperfectly closed jar upon our linen. The person who washed the linen had neglected to examine the inside of a stocking, which was filled with curare; and it was only on touching this glutinous matter with my hand, that I was warned not to draw on the poisoned stocking. The danger was so much the greater, as my feet at that time were bleeding from the wounds made by chegoes (Pulex penetrans), which had not been well extirpated. This circumstance may warn travellers of the caution requisite in the conveyance of poisons.

An interesting chemical and physiological investigation remains to be accomplished in Europe on the poisons of the New World, when, by more frequent communications, the curare de bejuco, the curare de raiz, and the various poisons of
the Ausaron, Guallaga, and Brazil, can be procured, without being confounded together, from the places where they are prepared. Since the discovery of prussic acid,* and many other new substances eminently deleterious, the introduction of poisons prepared by savage nations is less feared in Earope; we cannot however appeal to ostrongly to the rigilance of those who keep such noxious substances in the midst of populous cities, the centres of civilization, misery, and depravity. Our botanical knowledge of the plants employed in making poison can be but very slowly acquired. Most of the Indians who make poisoned arrows, are totally ignorant of the nature of the venomous substances they use, and which they obtain from other people. A mysterious reil everywhere covers the history of poisons and of their anstidotes. Their preparation among savages is the monopoly of the piaches, who are at once priests, jugglers, and physir cians; it is only from the natives who are tramsplanted to the missions, that any certain notions can be acquired on matters so problematical. Ages elapsed before Europenas became acquainted through the investigation of M. Mutis, with the bejuco del guaco (Mikamia guaco), which is the most pomerful of all antidotes against the bite of serpents, and of which we were forturate enough to give the first botanieal déscription.

The opinion is rery general in the mismions that no care is possible, if the curare be fresh, well concentrated, and harre staid long in the wound, to have entered freely into the circulation. Among the specifics employed on the benks of the Orinoco, and in the Indian Arehipelago, the most eelebrated is muriate of soda. $\dagger$ The wound is rubbed

[^320]with this salt, which is also taken internally. I had myself no direct and suffieiently convincing proof of the action of this specific; and the experiments of Delille and Majendie rather tend to disprove its efficacy. On the banks of the Amazon, the preference among the antidotes is given to eugar ; and muriate of soda being a substance almost unknown to the Indians of the forests, it is probable that the honey of bees, and that farinaceous sugar which oozes from plantains dried in the sun, were anciently employed throughout Guians. In vain have ammonia and eau-de-luce been tried against the curare ; it is now known that these specifics are uncertain, even when applied to wounds caused by the bite of serpents. Sir Everard Home has shown that a cure is often attributed to a remedy, when it is owing only to the slightness of the wound, and to a very circumscribed action of the poison. Animals may with impunity be wounded with poisoned arrows, if the wound be well laid open, and the point imbued with poison be withdrawn immediately after the wound is made. If salt or sugar be employed in these cases, people are tempted to regard them as excellent specifics. Indians, who had been wounded in battle by weapons dipped in the curare, described to us the symptoms they experienced, which were entirely similar to those observed in the bite of serpents. The wounded person feels congestion in the head, wertigo, and nassea. He is tormented by a raging thirst, and numbnese pervades all the parts that are near the wound.

The old Indian, who was called the poison-master, seemed flattered by the interest we took in his chemical processen. He found us sufficiently intelligent to lead him to the belief that we knew how to make soap, an art which, next to the preparation of curare, appeared to him one of the finest of human inventions. When the liquid poison had been poured into the vessels prepased for their reception, we
eatered into combination with the blood there is no remedy, either for man or any of the inferior animals. The wourali and other poisons mewtioned by Humboldt have, since the publication of this work, been carefully analysed by the first chemists of Europe, and experiments made on their sympooms and supposed remedies. Artificial inflation of the lungs was found the most successful, but in very few instances was any cure effected.]
accompanied the Indian to the festival of the juvias. The harvest of juvias, or fruits of the Bertholletia excelsa,* was celebrated by dancing, and by excesses of wild intoxication. The hut where the natives were assembled, displayed during several days a very singular aspect. There was neither table nor bench; but large roasted monkeys, blackened by smoke, were ranged in regular order against the wall. These were the marimondes (Ateles belzebuth), and those bearded monkeys called capuchins, which must not be confounded with the weeper, or sai (Simia capucina of Buffon). The manner of roasting these anthropomorphous animals contributes to render their appearance extremely disagreeable in the eyes of civilized man. A little grating or lattice of very hard wood is formed, and raised one foot from the ground. The monkey is skinned, and bent into a sitting posture; the head generally resting on the arms, which are meagre and long; but sometimes these are crossed behind the back. When it is tied on the grating, a very clear fire is kindled below. The monkey, enveloped in smoke and flame, is broiled and blackened at the same time. On seeing the natives devour the arm or leg of a roasted monkey, it is difficult not to believe that this habit of eating animals so closely resembling man in their physical organization, has, to a certain degree, contributed to diminish the horror of cannibalism among these people. Roasted monkeys, particularly those which have very round heads, display a hideous resemblance to a child; and consequently Europeans who are obliged to feed on them prefer separating the head and the hands, and serve up only the rest of the animal at their tables. The flesh of monkeys is so lean and dry, that M. Bonpland has preserved in his collections at Paris an arm and hand, which had been broiled over the fire at Esmeralda; and no smell has arisen from them after the lapse of a great number of years.

We saw the Indians dance. The monotony of their dancing is increased by the women not daring to take part in it. The men, young and old, form a circle, holding each others' hands; and turn sometimes to the right, sometimes to the left, for whole hours, with silent gravity. Most frequently

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* The Brazil-nut.
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the dancers themselves are the musicians. Feeble sounds, drawn from a series of reeds of different lengths, form a slow and plaintive accompaniment. The first dancer, to mark the time, bends hoth knees in a kind of cadence. Sometimes they all make a pause in their places, and execute little oscillatory movements, bending the body from one side to the other. The reeds ranged in a line, and fastened together, resemble the Pan's pipes, as we find them represented in the bacchanalian processions on Grecian vases. To unite reeds of different lengths, and make them sound in succession by passing them before the lips, is a simple idea, and has naturally presented itself to every nation. We were surprised to see with what promptitude the young Indians constructed and tuned these pipes, when they found reeds on the bank of the river. Uncivilized men, in every zone, make great use of these gramina with high stalks. The Greeks, with truth, said that reeds had contributed to subjugate nations by furnishing arrows, to soften men's manners by the charm of music, and to unfold their understanding by affording the first instruments for tracing letters. These different uses of reeds mark in some sort three different periods in the life of nations. We must admit that the tribes of the Orinoco are in the first stage of dawning civilization. The reed serves them only as an instrument of war and of hunting; and the Pan's pipes, of which we have spoken, have not yet, on those distant shores, yielded sounds capable of awakening mild and humane feelings.

We found in the hut allotted for the festival, several vegetable productions which the Indians had brought from the mountains of Guanaya, and which engaged our attention. I shall only here mention the fruit of the juvia, reeds of a prodigious length, and shirts made of the bark of marima. The almendron, or juvia, one of the most majestic trees of the forests of the New World, was almost unknown before our visit to the Rio Negro. It begins to be found after a journey of four days east of Esmeralda, between the Padamo and Ocamo, at the foot of the Cerro Mapaya, on the right bank of the Orinoco. It is still more abundant on the left bank, at the Cerro Guanaja, between the Rio Amaguaca and the Gehette. The inhabitants of
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3nmeralda assured us, that in advancing above the Gehette and the Chiguire, the juvia and cacao-trees become so common that the wild Indians (the Guaicas and Guaharibos) do not disturb the Indians of the missions when gathering in their harvests. They do not envy them the productions with which nature has enriched their own soil. Scarcely any attempt has been made to propagate the almendrones in the settlements of the Upper Orinoco. To this the indolence of the inhabitants is a greater obstacle than the rapidity with which the oil becomes rancid in the amygdaliform seeds. We found only three trees of the kind at the mission of San Carlos, and two at Esmeralda. These majestic trees were eight or ten years old, and had not yet borne flowers.

As early as the sixteenth century, the seeds with ligneous and triangular teguments (but not the great drupe like a cocoa-nut, which contains the almonds, were known in Europe. I recognise them in an imperfect engraving of Clusius." This botanist designates them under the name of almendras del Peru. They had no doubt been carried, as a very rare fruit, to the Upper Marañon, and thence, by the Cordilleras, to Quito and Peru. The ' Novus Orbis' of Laet, in which I found the first account of the cow-tree, furnishes also a description and a figure singularly exact of the fruit of the bertholletia. Laet calls the tree totocke, and mentions the drupe of the size of the human head, which contains the almonds. The weight of these fruits, he says, is so enormous, that the savages dare not enter the forests without covering their heads and shoulders with a buckler of very hard wood. These bucklers are unknown to the natives of Esmeralda, but they told us of the danger incurred when the fruit ripens and falls from a height of fifty or sixty feet. The triangular seeds of the juvia are sold in Portugal under the rague appellation of chesnuts (castañas) of the Amazon, and in England under the name

* Clusius distingnishes very properly the almendras del Peru, our Bertholletia excelsa, or jevia, (fructus amygdalæ-nucleo, triangularis, dorso lato, in bina latera angulosa desinente, rugosus, paululum cuncifornis) from the pekea, or Amygdala guayanica. Raleigh, who knew none of the productions of the Upper Orinoco, does not speak of the juevia; but it appears that he first brought to Europe the fruit of the maxritia palm, of which we have so often spoken. (Fructus elegantisuimus, squamonas, similis pahmæ-pini.)
of Brazil-nuts; and it was long believed that, like the fruit of the pekea, they grew on separate stalks. They have furnished an article of trade for a century past to the inhabitants of Grand Para, by whom they are sent either directly to Europe, or to Cayenne, where they are called touka. The-celebrated botanist, Correa de Serra, told us that this tree abounds in the forests in the neighbourhood of Macapa, at the mouth of the Amazon; that it there bears the name of eapucaya, and that the inhabitants gather the almonds, like those of the lecythis, to express the oil. A cargo of almonds of the juvia, brought into Havre, captured by a privateer, in 1807, was employed for the same purpose.

The tree that yields the Brazil-nuts is generally not more than two or three feet in diameter, but attains one hundred or one hundred and twenty feet in height. It does not resemble the mammee-tree, the star-apple, and several other trees of the tropics, the branches of which (as in the laureltrees of the temperate zone) rise alnost straight towards the .sky. The branches of the bertholletia are open, very long, almost entirely bare towards the base, and loaded at their summits with tufts of very close foliage. This disposition of the semicoriaceous leaves, which are a little silvery on their under part, and more than two feet long, makes the branches bend down toward the ground, like the fronds of the palmtree. We did not see this majestic tree in blossom: it is not loaded with flowers* till in its fifteenth year, and they appear about the end of March and the beginning of April. The fruits ripen towards the end of May, and some trees retain them till the end of August. These fruits, which are as large as the head of a child, often twelve or thirteen inches in diameter, make a very loud noise in falling from the 'tops of the trees. Nothing is more fitted to fill the mind with admiration of the force of organic action in the equinoctial zone than the aspect of those great ligneous pericarps, for instance, the cocoa-tree (lodoicea) of the Maldives

[^321]among the monocotyledons, and the bertholletia and the lecythis among the dicotyledons. In our climates only the cucurbitaceæ produce in the space of a few months fruits of an extraordinary size; but these fruits are pulpy and succulent. Within the tropics, the bertholletia forms in less than fifty or sixty days a pericarp, the ligneous part of which is half an inch thick, and which it is difficult to saw with the sharpest instruments. A great naturalist has observed, that the wood of fruits attains in general a hardness which is scarcely to be found in the wood of the trunks of trees. The pericarp of the bertholletia has traces of four cells, and I have sometimes found even five. The seeds have two very distinct coverings, and this circumstance renders the structure of the fruit more complicated than in the lecythis, the pekea or caryocar, and the saouvari. The first tegument is osseous or ligneous, triangular, tuberculated on its exterior surface, and of the colour of cinnamon. Four or five, and sometimes eight of these triangular nuts, are attached to a central partition. As they are loosened in time, they move freely in the large spherical pericarp. The capuchin monkeys (Simia chiropotes) are singularly fond of the Brazil nuts; and the noise made by the seeds, when the fruit is shaken as it falls from the tree, excites the appetites of these animals in the highest degree. I have most frequently found only from fifteen to twenty-two nuts in each fruit. The second tegument of the almonds is membranaceous, and of a brown-yellow. Their taste is extremely agreeable when they are fresh; but the oil, with which they abound, and which is so useful in the arts, becomes easily rancid. Although at the Upper Orinoco we often ate considerable quantities of these almonds for want of other food, we never felt any bad effects from so doing. The spherical pericarp of the bertholletia, perforated at the summit, is not dehiscent; the upper and swelled part of the columella forms (according to M. Kunth) a sort of inner cover, as in the fruit of the lecythis, but it seldom opens of itself. Many seeds, from the decomposition of the oil contained in the cotyledons, lose the faculty of germination before the rainy season, in which the ligneous integument of the pericarp opens by the effect of putrefaction. A tale is very current on the banks of the

Lower Orinoco, that the capuchin and cacajao monkeys (Simia chiropotes, and Simia melanocephala) place themselves in a circle, and, by striking the shell with a stone, succeed in opening it, so as to take out the triangular nuts. This operation must, however, be impossible, on account of the extreme hardness and thickness of the pericarp. Monkeys may have been seen rolling along the fruit of the bertholletia, but though this fruit has a small hole closed by the upper extremity of the columella, nature has not furnished monkeys with the means of opening the ligneous pericarp, as it has of opening the covercle of the lecythis, called in the missions "the covercle of the monkeys' cocoa."* According to the report of several Indians, only the smaller rodentia, particularly the cavies (the acuri and the lapa), by the structure of their teeth, and the inconceivable perseverance with which they pursue their destructive operations, succeed in perforating the fruit of the juvia. As soon as the triangular nuts are spread on the ground, all the animals of the forest, the monkeys, the manaviris, the squirrels, the cavies, the parrots, and the macaws, hastily assemble to dispute the prey. They have all strength enough to break the ligneous tegument of the seed; they get out the kernel, and carry it to the tops of the trees. "It is their festival also," said the Indians who had returned from the harvest; and on hearing their complaints of the animals, one may perceive that they think themselves alone the lawful masters of the forest.

One of the four canoes, which had taken the Indians to the gathering of the juvias, was filled in great part with that species of reeds (carices), of which the blow-tubes are made. These reeds were from fifteen to seventeen feet long, yet no trace of a knot for the insertion of leaves and branches was perceived. They were quite straight, smooth externally, and perfectly cylindrical. These carices come from the foot of the mountains of Yumariquin and Guanaja. They are much sought after, even beyond the Orinoco, by the name of 'reeds of Esmeralda.' 'A hunter preserves the same blow-tube during his whole life, and boasts of its lightness and precision, as we boast of the same qualities in

[^322]our fire-arms. What is the monocotyledonous plant that furnishes these admirable reeds? Did we see in fact the internodes (parts between the knots) of a gramen of the tribe of nastoides? or may this carex be perhaps a cyperaceousplantt destitute of knots : I cannot solve this question, or determine to what genus another plant belongs, which furnishes the shirts of marima. We saw on the slope of the Cerra Duidr 'shirt-trees' fifty feet high. The Indians cut off cylindrical pieces two feet in diameter, from which they peel the red and fibrous bark, without making any longitudinal incision. This bark affords them a sorti of garment, which resembles sacks of a very coarse texture, and without a seam. The upper opening serves for the head; and two lateral holes are cut for the arms to pass through. The natives wear these shirts of marima in the rainy season: they have the form of the ponchos and ruanas of cotton, which are so common in New Grenada, at Quito, and in Peru. In these climates the riches and beneficence of nature being regarded as the primary causes of the indolence of the inhabitants, the missionaries say in showing the shirts of marima, "in the forests of the Orinoeo garments are found ready-made on the trees." We may also mention the pointed caps, which the spathes of certain palm-trees furnish, and which resemble coarse network.
At the festival of which we were the spectators, the women, who were excluded from the dance, and every sort of public rejoicing, were daily occupied in serving the men with roasted monkey, fermented liquors, and palmcabbage. This last production has the taste of our cauliflowers, and in no other country had we seen specimens of such an immense size. The leaves that are not unfolded are united with the young stem, and we measured cylindery of six feet long and five inches in diameter. Another substance, which is much more nutritive, is obtained from the animal kingdom: this is fish-flour (manioc de pescado). The Indians throughout the Upper Orinoco fry fish, dry

[^323]them in the sun, and reduce them to powder without. separating the bones. I have seen masses of fifty or sixty pounds of this flour, which resembles that of cassava. When it is wanted for eating, it is mixed with water, and reduced to a paste. In every climate the abundance of fish has led to the invention of the same means of preserving them. Pliny and Diodorus Siculus have described the fishbread of the ichthyophagous nations, that dwelt on the Persian Gulf and the shores of the Red Sea.*

At Esmeralda, as everywhere else throughout the missions, the Indians who will not be baptized, and who are merely. aggregated in the community, live in a state of polygamy. The number of wives differs much in different tribes. It is most considerable among the Caribs, and all the nations that have preserved the custom of carrying off young girls from the neighbouring tribes. How can we imagine domestic happiness in so unequal an association? The women live in a sort of slavery, as they do in most nations which are in a state of barbarism. The husbands being in the full enjoyment of absolute power, no complaint is heard in their presence. An apparent tranquillity prevails in the household; the women are eager to anticipate the wishes of an imperious and sullen master; and they attend without distinction to their own children and those of their rivals. The missionaries assert, what may easily be believed, that this domestic peace, the effect of fear, is singularly disturbed when the husband is long absent. The wife who contracted the first ties then applies to the others the names of concubines and servants. The quarrels continue till the return of the master, who knows how to calm their passions by the sound of his voice, by a mere gesticulation, or, if he thinks it necessary, by means a little more violent. A certain inequality in the rights of the women is sanctioned by the language of the Tamanacs. The husband calls the second and third wife the companions of the first; and the first treats these companions as rivals and enemies (ipucjatoje),

[^324]a term which truly expresses their position. The whole weight of labour being supported by these unhappy women, we must not be surprised if, in some nations, their number is extremely small." Where this happens, a kind of polyandry is formed, which we find more fully displayed in Thibet, and on the lofty mountains at the extremity of the Indian peninsula. Among the Avanos and Maypures, brothers have often but one wife. When an Indian, who lives in polygamy, becomes a christian, he is compelled by the missionaries, to choose among his wives her whom he prefers, and to reject the others. At the moment of separation the ncw convert sometimes discovers the most valuable qualities in the wives he is obliged to abandon. One understands gardening perfectly; another knows how to prepare chiza, an intoxicating beverage extracted from the root of cassava; all appear to him alike clever and useful. Sometimes the desire of preserving his wives overcomes in the Indian his inclination to christianity; but most frequently, in his perplexity, the husband prefers submitting to the choice of the missionary, as to a blind fatality.

The Indians, who from May to August take journeys to the east of Esmeralda, to gather the vegetable productions of the mountains of Yumariquin, gave us precise notions of the course of the Orinoco to the east of the mission. This part of my itinerary may differ entirely from the maps that preceded it. I shall begin the description of this country with the granitic group of Duida, at the foot of which we sojourned. This group is bounded on the west by the Rio Tamatama, and on the east by the Rio Guapo. Between these two tributary streams of the Orinoco, amid the morichales, or clumps of mauritia palm-trees, which surround Esmeralda, the Rio Sodomoni flows, celebrated for the excellence of the pine-apples that grow upon its banks. I measured, on the 22nd of May, in the savannah at the foot of Duida, a base of four hundred and seventy-five metres in length; the angle, under which the summit of the mountain appeared at the distance of thirteen thousand three hundred and twenty-seven metres, was still nine degrees. A trigonometric measurement, made with great care, gave me for Duida (that is, for the most elevated peak, which is south-west of the Cerro Maraguaca) two thousand
one hundred and seventy-nine metres, or one thousand one hundred and eighteen toises, above the plain of Esmeralda. The Cerro Duida thus yields but little in height (scarcely eighty or one hundred toises) to the summit of St. Gothard, or the Silla of Caracas on the shore of Venezuela. It is indeed considered as a colossal mountain in those countries; and this celebrity gives a precise idea of the mean height of Parima and of all the mountains of eastern America. To the east of the Sierra Nevada de Merida, as well as to the south-east of the Paramo de las Rosas, none of the chains that extend in the same parallel line reach the height of the central ridge of the Pyrenees.

The granitic summit of Duida is so nearly perpendicular that the Indians have vainly attempted the ascent. It is a well-known fact that mountains not remarkable for elevation are sometimes the most inaccessible. At the beginning and end of the rainy season, small flames, which seem to change their place, are seen on the top of Duida. This phenomenon, the existence of which is borne out by concurrent testimony, has caused this mountain to be improperly called a volcano. As it stands nearly alone, it might be supposed that lightning from time to time sets fire to the brushwood; but this supposition loses its probability when we reflect on the extreme difficulty with which plants are ignited in these damp climates. It must be observed also that these flames are said to appear often where the rock seems scarcely covered with turf, and that the same igneous phenomena are visible, on days entirely exempt from storms, on the summit of Guaraco or Murcielago, a hill opposite the mouth of the Rio Tamatama, on the southern bank of the Orinoco. This hill is scarcely elevated one hundred toises above the neighbouring plains. If the statements of the natives be correct, it is probable that some subterraneous cause produces these flames on the Duida and the Guaraco ; for they never appear on the lofty neighbouring mountains of Jao and Maraguaca, so often wrapped in electric storms. The granite of the Cerro Duida is full of veins, partly open, and partly filled with crystals of quartz and pyrites. Gaseous and inflammable emanations, either of hydrogen or of naphtha, may pass through these veins. Of this the mountains of Caramania,
of Hindookho, and of Himalaya, furnish frequent examples. We saw the appearance of flames in many parts of eastern America subject to earthquakes, even from secondary rocks, as at Cuchivero, near Cumanacoa. The fire shows itself when the ground, strongly heated by the sun, receives the first rains; or when, after violent showers, the earth begins to dry. The first cause of these igneous phenomena lies at immense depths below the secondary rocks, in the primitive formations: the rains and the decomposition of atmospheric water act only a secondary part. The hottest springe of the globe isque immediately from granite. Petroleum. gushes from mica-schist; and frightful detonations are heard at Encaramada, between the rivers Arauca and Cuchivero, in the midst of the granitio soil of the Orinoco and the Sierra Parima. Here, as everywhere else on the globe, the focus of volcanos is in the most ancient soils; and it appears that an intimate connection exists between the great phenomena that heave up and liquify the crust of our planet, and those igneous meteors which are seen from time to time on its surface, and which from their littleness we are tempted to attribute solely to the influence of the atmosphere.

Duida, though lower than the height assigned to it by popular belief, is however the most prominent point of the whole group of mountains that separate the basin of the Lower Orinoco from that of the Amazon. These mountains lower still more rapidly on the northeast, toward the Purunama, than on the oast, toward the Padamo and the Rio Ocamo. In the former direction the most elevated summits next to Duida are Cuneva, at the sources of the Rio Paru (one of the tributary streams of the Ventuari), Sipapo, Calitamini, which forms one group with Cunavami and the peak of Uniana. East of Duida, on the right bank of the Orinoco, Maravaca, or Sierra Maraguaca, is distinguished by its elevation, between the Rio Caurimoni and the Padamo; and on the left bank of the Orinoco rise the mountains of Guanaja and Yumariquin, between the Rios Amaguaca and Gehette. It is almost superfluous to repeat that the line which passes through these lofty summits (like those of the Pyrenees, the Carpathian mountains, and so many other chains of the old continent) is very distinct
from the line that marks the partition of the waters. This latter line, which separates the tributary streams of the Lower and Upper Orinoco, intersects the meridian of $64^{\circ}$ in latitude $4^{\circ}$. After having separated the sources of the Rio Branco and the Carony, it runs north-west, sending off the waters of the Padamo, the Jao, and the Ventuari towards the south, and the waters of the Arui, the Caura, and the Cuchivero towards the north.

The Orinoco may be ascended without danger from Bsmeralda as far as the cataracts occupied by the Guaica Indians, who prevent all farther progress of the Spaniards. This is a voyage of six days and a half. In the first two days you arrive at the mouth of the Rio Padamo, or Patamo, having passed, on the north, the little rivers of Tamatama, Sodomoni, Guapo, Caurimoni, and Simirimoni; and on the south the Cuca; situate between the rock of Guaraco, which is said to throw out flames, and the Cerro Canclilla. Throughout this course the Orinoco continues to be three or four hundred toises broad. The tributary streams are most frequent on the right bank, because on that side the river is bounded by the lofty cloud-capped mountains of Duida and Maraguaca, while the left bank on the contrary is low and contiguous to a plain, the general slope of which inclines to the south-west. The northern Cordilleras are covered with fine timber. The growth of plants is so enormous in this hot and constantly humid climate, that the tranks of the Bombax ceiba are sixteen feet in diameter. From the mouth of the Rio Padamo, which is of considerable breadth, the Indians arrive, in a day and a half, at the Rio Mavaca. The latter takes its rise in the lofty mountains of Unturan, and communicates with a lake, on the banks of which the Portuguese* of the Rio Negro gather the aromatic seeds of the Laurus pucheri, known in trade by the names of the pichurim bean, and

[^325]toda specie. Between the confluence of the Padamo and that of the Mavaca, the Orinoco receives on the north the Ocamo, into which the Rio Matacona falls. At the sources of the latter live the Guainares, who are much less coppercoloured, or tawny, than the other inhabitants of those countries. This is one of the tribes called by the missionaries 'fair Indians' (Indios blancos). Near the mouth of the Ocamo, travellers are shown a rock, which is the wonder of the country. It is a granite passing into gneiss, and remarkable for the peculiar distribution of the black mica, which forms little ramified veins. The Spaniards call this rock Piedra Mapaya (the map-stone). The little fragment which I procured indicated a stratified rock, rich in white feldspar, and containing, together with spangles of mica, grouped in streaks, and variously twisted, some crystals of hornblende. It is not a syenite, but probably a granite of new formation, analagous to those to which the stanniferous granites (hyalomictes) and the pegmatites, or graphic granites, belong.

Beyond the confluence of the Macava, the Orinoco suddenly diminishes in breadth and depth, becoming extremely sinuous, like an Alpine torrent. Its banks are surrounded by mountains, and the number of its tributary streams on the south augments considerably, yet the Cordillera on the north remains the most elevated. It requires two days to go from the mouth of the Macava, to the Rio Gehette, the navigation being very difficult, and the boats, on account of the want of water, being often dragged along the shore. The tributary streams along this distance are, on the south, the Daracapo and the Amaguaca; which skirt on the west and east the mountains of Guanaya and Yumariquin, where the bertholletias are gathered. The Rio Manaviche flows down fron the mountains on the north, the elevation of which diminishes progressively from the Cerro Maraguaca. As we advance further up the Orinoco, the whirlpools and little rapids (chorros y remolinos) become more and more frequent; on the north lies the Caño Chiquire, inhabited by the Guaicas, another tribe of white Indians; and two leagues distant is the mouth of the Gehette, where there is a great cataract. A dyke of granitic rocks crosses the Orinoco; these rocks are, as it were,
the columns of Hercules, beyond which no white man has been able to penetrate. It appears, that this point, known by the name of the great Raudal de Guaharibos, is threequarters of a degree west of Esmeralda, consequently in longitude $67^{\circ} 38^{\prime}$. A military expedition, undertaken by the commander of the fort of San Carlos, Don Francisco Bovadilla, to discover the sources of the Orinoco, led to some information respecting the cataracts of the Guaharibos. Bovadilla had heard, that some fugitive negroes from Dutch Guiana, proceeding towards the west (beyond the isthmus between the sources of the Rio Carony and the Rio Branco), had joined the independent Indians. He attempted an entrada (hostile incursion), without having obtained the permission of the governor; the desire of procuring African slaves, better fitted for labour than the copper-coloured race, was a far more powerful motive than that of zeal for the progress of geography. Bovadilla arrived without diffculty as far as the little Raudal* opposite the Gehette; but having advanced to the foot of the rocky dike that forms the great cataract, he was suddenly attacked, while he was breakfasting, by the Guaharibos and Guaycas, two warlike tribes, celebrated for the virulence of the curare with which their arrows are empoisoned. The Indians occupied the rocks that rise in the middle of the river, and seeing the Spaniards without bows, and having no knowledge of firearms, they provoked the whites, whom they believed to be without defence. Several of the latter were dangerously wounded, and Bovadilla found himself forced to give the signal for battle. A fearful carnage ensued among the natives, but none of the Dutch negroes, who, as was believed, had taken refuge in those parts, were found. Notwithstanding a victory so easily won, the Spaniards did not dare to advance eastward in a mountainous country, and along a river inclosed by very high banks.

These white Guaharibos have constructed a bridge of lianas above the cataract, supported on rocks that rise, as generally happens in the pongos of the Upper Marañon, in the middle of the river. The existence of this bridge,

[^326]which is known to all the intrabitants of Fismeralda,* seems to indicate that the Ormoco must be very narrow at this point. It is generally estimated by the Indians to be only two or three hundred feet broad. They asy, that the Orinoco, above the Raudal of the Quaharibos, is no longer a river, but a brook (riachuelo) ; while a well informed ecclosiastic, Fray Juan Gonzales, who had visited those countries, assured me, that the Orinoco, in the part where its farther course is no no longer known, is two-thirds of the breadth of the Rio Negro near Sam Carlos. This opinion appears to me hardly probable; but I relate what I have collected, and affirm nothing positively.

In the rocky dike that cromses the Orinoco, forming the Raudal of the Guaharibos, Spanish soldiers pretend to have found the fine kind of saussurite (Amazon-stone), of which we have spoken. This tradition however is very uncertain; and the Indians, whom I interrogated on the subject, assmred me, that the green stones, called piedras de MMcaguat at Esmeralda, were purchased from the Guaicas and Guaharibos, who traffic with hordes much farther to the east. The same uncertainty prevails respecting these stones, as that which attaches to many other valuable productions of the Indies. On the coast, at the distance of some hundred leagues, the country where they are found is positively named; but when the traveller with difficulty penetrates into that country, he discovers that the natives are ignorant oven of the name of the object of his research. It might be supposed that the amulets of saussurite found in the possession of the Indians of the Rio Negro, come from the Lower Marañon, while those that are received by the missions of the Upper Orinoco and the Rio Carony come from a country situated between the soaroes of the Eesequibo and the Rio Branco. The opinion that this stone is taken in

[^327]a soft state like paste from the little lake Ammen, though very prevalent at Angostura, is wholly without foundation. A curious geognostic discovery remains to be made in the eastern part of America, that of finding in a primitive soil a rock of euphotide containing the piedra de Macugua.

I shall here proceed to give some information respecting the tribes of dwarf and fair Indians, which ancient traditions have placed near the sources of the Orinoco. I had an opportunity of seeing some of these Indians at Esmeralda, and can affirm, that the short stature of the Guaicas, and the fair complexion of the Guaharibos, whom Father Caulin calls Guaribos blancos, have been alike exaggerated. The Guaicas, whom I measured, were in general from four feet seven inches to four feet eight inches high (old measure of France).* We were assured that the whole tribe were of this diminutive size; but we must not forget that what is called a tribe constitutes, properly speaking, but one family, owing to the exclusion of all foreign connections. The Indians of the lowest stature next to the Guaicas are the Guainares and the Poignaves. It is singular, that all these nations are found in near proximity to the Caribs, who are remarkably tall. They all inhabit the same climate, and subsist on the same aliments. They are varieties in the race, which no doubt existed previously to the settlement of these tribes, (tall and short, fair and dark brown) in the same country. The four nations of the Upper Orinoco, which appeared to me to be the fairest, are the Guaharibos of the Rio Gehette, the Guainares of the Ocamo, the Guaicas of Caño Chiguire, and the Maquiritares of the sources of the Padamo, the Jao, and the Ventuari. It being very extraordinary to see natives: with a fair skin beneath a burning sky, and amid nations of a very dark hue, the Spaniards have attempted to explain this phenomenon by the following hypotheses. Some assert. that the Dutch of Surinam and the Rio Essequibo may havintermingled with the Guaharibos and the Guainares: others insist, from hatred to the Capuchins of the Carony. and the Observantins of the Orinoco, that the fair Indian:are what are called in Dalmatia muso di frate, children, whose legitimacy is somewhat doubtful. In either casi the Indios blancos would be mestizos, that is to eay; childre1. * About five feet three inches English measure.
of an Indian woman and a white man. Now, having seen thousands of mestizos, I can assert that this supposition is altogether inaccurate. The individuals of the fair tribes, whom we examined, have the features, the stature, and the smooth, straight, black hair which characterises other Indians. It would be impossible to take them for a mixed race, like the descendants of natives and Europeans. Some of these people are very little, others are of the ordinary stature of the copper-coloured Indians. They are neither feeble, nor sickly, nor are they albinos; and they differ from the copper-coloured races only by a much less tawny skin. It would be useless, after these considerations, to insist on the distance of the mountains of the Upper Orinoco from the shores inhabited by the Dutch. I will not deny that descendants of fugitive negroes may have been seen among the Caribs, at the sources of the Essequibo; but no white man ever went from the eastern coast to the Rio Gehette and the Ocamo, in the interior of Guiana. It must also be observed, although we may be struck with the singularity of several fair tribes being found at one point to the east of Esmeralda, it is no less certain, that tribes have been found in other parts of America, distinguished from the neighbouring tribes by the less tawny colour of their skin. Such are the Arivirianos and Maquiritares of the Rio Ventuario and the Padamo, the Paudacotos and Paravenas of the Erevato, the Viras and Araguas of the Caura, the Mologagos of Brazil, and the Guayanas of the Uruguay.*

[^328]These phenomena are so much the more worthy of attention as they are observed in that great branch of the American nations generally ranked in a class totally opposite to that circumpolar branch, viz; the Tschougaz-Esquimaux,* whose children are fair, and who acquire the Mongol or yellowish tint only from the influence of the air and the humidity. In Guiana, the hordes who live in the midst of the thickest forests are generally less tawny than those who inhabit the shores of the Orinoco, and are employed in fishing. But this slight difference, which is alike found in Europe between the artisans of towns and the cultivators of the fields or the fishermen on the coasts, in no way explains the problem of the Indios blancos. They are surrounded by other Indians of the woods (Indios del monte), who are of a reddish-brown, although now exposed to the same physical influences. The causes of these phenomena are very ancient, and we may repeat with Tacitus, "est durans originis vis."

The fair-complexioned tribes, which we had an opportunity of seeing at the mission of Esmeralda, inhabit part of a mountainous country lying between the sources of six tributaries of the Orinoco; that is to say, between the Padamo, the Jao, the Ventuari, the Erevato, the Aruy, and the Paraguay. $\dagger$ The Spanish and Portuguese missionaries are accustomed to designate this country more particularly
beginning of the 16th century, we see, that the discovery of America, and of a new race of men, had singularly awakened the interest of travellers respecting the varieties of our species. Now, if a black race had been mingled with copper-coloured men, as in the South-sea Islands, the conquistadores would not have failed to speak of it in a precise manner. Besides, the religious traditions of the Americans relate the appearance, in the heroic times, of white and bearded men as priests and legislators; but none of these traditions make mention of a black race.

* The Chevalier Gieseke has recently confirmed all that Krantz related of the colour of the skin of the Esquimaux. That race (even in the latitude of seventy-five and seventy-six degrees, where the climate is so rigorous) is not in general so diminutive as it was long believed to be. Ross's Voyaye to the North.
$\dagger$ They are six tributary streams on the right bank of the Orinoco; the first three run towards the south, or the Upper Orinoco ; the three others towards the north, or the Lower Orinoco.
by the name of Parima.* Here, as in several other countrien of Spanish America, the savages have reconquered what had been wrested from them by civilization, or rather by its precursors, the missionaries. The expedition of the boundaries under Solano, and the extravagant zeal displayed by a governor of Guiana for the discovery of El Dorado, partially revived in the latter half of the eighteenth century that spirit of enterprise which characterised the Spaniards at the period of the discovery of America. In going along the Rio Padamo, a road was observed across the forests and savannahs (the length of ten days' journey), from Esmeralda to the sources of the Ventuari; and in two days more, from those sources, by the Erevato, the missions on the Rio Caura were reached. Two intelligent and enterprising men, Don Antonio Santos and Captain Bareto, had established, with the aid of the Miquiritares, a chain of military posts on this line from Esmeralda to the Rio Erevato. These posts consisted of block-houses (casas fuertes), mounted with swivels, such as I have already mentioned. The soldiers, left to themselves, exercised all kinds of vexations on the natives (Indians of peace), who had cultivated pieces of ground around the casas fiortes; and the consequence was that, in 1776, several tribes formed a league against the Spaniards. All the military posts were attacked on the same night, on a line of nearly fifty leagues in length. The houses were burnt, and many soldiers massacred; a very small number only owing their preservation to the pity of the Indian women. This nocturnal expedition is still mentioned with horror. It was concerted in the most profound secresy, and executed with that spirit of unity which the natives of America, skilled in concealing their hostile passions, well know how to practise in whatever concerns their common interests. Since 1776 no attempt has been made to re-establish the road which leads by land from the Upper to the Lower Orinoco, and no white man has been able to pass from Esmeralda to the

[^329]Brevato. It is certain, however, that in the mountainous lands, between the sources of the Padamo and the Ventuari (near the sites called by the Indians Aurichapa, Ichuana, and Irique) there are many spots where the climate is temperate, and where there are pasturages capable of feeding numerous herds of cattle. The military posts were very useful in preventing the incursions of the Caribs, who, from time to time carried off slaves, though in very small numbers, between the Erevato and the Padamo. They would have resisted the attacks of the natives, if, instead of leaving them isolated and solely to the control of the soldiery, they had been formed into communities, and governed like the villages of neophyte Indians.

We left the mission of Esmeralda on the 23rd of May. Without being positively ill, we felt ourselves in a state of languor and weakness, caused by the torment of insects, bad food, and a long voyage, in narrow and damp boats. We did not go up the Orinoco beyond the mouth of the Rio Guapo, which we should have done, if we could have attempted to reach the sources of the river. There remains a distance of fifteen leagues from the Guapo to the Raudal of the Guaharibos. At this cataract, which is passed on a bridge of lianas, Indians are posted armed with bows and arrows, to prevent the whites, or those who come from their territory from advancing westward. How could we hope to pass a point where the commander of the Rio Negro, Don Francisco Bovadilla, was stopped when, accompanied by his soldiers, he tried to penetrate beyond the Gehette ?* The carnage then made among the natives has rendered them more distrustful, and more averse to the inhabitants of the missions. It must be remembered that the Orinoco had hitherto offered to geographers two distinct problems, alike important, the situation of its sources, and the mode of its communication with the Amazon. The latter problem formed the object of the journey which I have described; with respect to the discovery of its sources, that remains to be done by the Spanish and Portuguese governments.

Our canoe was not ready to receive us till near three o'clock in the afternoon. It had been filled with innu-

* See p. 461.

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merable swarms of ants during the navigation of the Cassiquiare; and the toldo, or roof of palm-leaves, beneath which we were again doomed to remain stretched out during twenty-two days, was with difficulty cleared of these insects. We employed part of the morning in repeating to the inhabitants of Esmeralda the questions we had already put to them, respecting the existence of a lake towards the east. We showed copies of the maps of Surville and La Cruz to old soldiers, who had been posted in the mission ever since its first establishment. They laughed at the supposed communication of the Orinoco with the Rio Idapa, and at the 'White Sea,' which the former river was represented to cross. What we politely call geographical fictions they termed "lies of the old world" (mentiras de por allà). These good people could not comprehend how men, in making the map of a country which they had never visited, could pretend to know things in minute detail, of which persons who lived on the spot were ignorant. The lake Parima, the Sierra Mey, and the springs which separate at the point where they issue from the earth, were entirely unknown at Esmeralda. We were repeatedly assured that no one had ever been to the east of the Raudal of the Guaharibos; and that beyond that point, according to the opinion of some of the natives, the Orinoco descends like a small torrent from a group of mountains, inhabited by the Coroto Indians. Father Gili, who was living on the banks of the Orinoco when the expedition of the boundaries arrived, says expressly, "that Don Apollinario Diez was sent in 1765 to attempt the discovery of the source of the Orinoco; that he found the river, east of Esmeralda, full of shoals; that he returned for want of provision; and that he learned nothing, absolutely nothing, of the existence of a lake." This statement perfectly accords with what I heard myself thirty-five years later at Esmeralda. The probability of a fact is powerfully shaken when it can be proved to be totally unknown on the very spot where it ought to be known best; and when those by whom the existence of the lake is affirmed contradict each other, not in the least essential circumstances, but in all that are the most important.

When travellers judge only by their own sensations they differ from each other respecting the abundance of the mosquitos as they do respecting the progressive increase or diminution of the temperature. The state of our organs, the motion of the air, its degree of humidity or dryness, its electric intensity, a thousand circumstances contribute at once to make us suffer more or less from the heat and the insects. My fellow travellers were unanimously of opinion that Esmeralda was more tormented by mosquitos than the banks of the Cassiquiare, and even more than the two missions of the Great Cataracts; whilst I, less sensible than they of the high temperature of the air, thought that the irritation produced by the insects was somewhat less at Esmeralda than at the entrance of the Upper Orinoco. On hearing the complaints that are made of these tormenting insects in hot countries it is difficult to believe that their absence, or rather their sudden disappearance, could become a subject of inquietude; yet such is the fact. The inhabitants of Esmeralda related to us, that in the year 1795, an hour before sunset, when the mosquitos usually form a very thick cloud, the air was observed to be suddenly free from them. During the space of twenty minutes, not one insect was perceived, although the sky was cloudless, and no wind announced rain. It is necessary to have lived in those countries to comprehend the degree of surprise which the sudden disappearance of the insects must have produced. The inhabitants congratulated each other, and inquired whether this state of happiness, this relief from pain (felicidad y alivio), could be of any duration. But soon, instead of enjoying the present, they yielded to chimerical fears, and imagined that the order of nature was perverted. Some old Indians, the sages of the place, asserted that the disappearance of the insects must be the precursor of a great earthquake. Warm discussions arose; the least noise amid the foliage of the trees was listened to with an attentive ear; and when the air was again filled with mosquitos they were almost hailed with pleasure. We could not guess what modification of the atmosphere had caused this phenomenon, which must not be confounded with the periodical replacing of one species of insects by another.

After four hours' navigation down the Orinoco we arrived at the point of the bifurcation. Our resting place was on the same beach of the Cassiquiare, where a few days proviously our great dog had, as we believe, been carried off by the jaguars. All the endeavours of the Indians to discover any traces of the animal were fruitless. The cries of the jaguars were heard during the whole night.* Theme animals are very frequent in the tracts situated between the Cerro Maraguaca, the Unturan, and the banks of the Pamoni. There also is found that black species of tiger $\dagger$ of which I saw some fine skins at Esmeralda. This animal is celebrated for its strength and ferocity; it appears to be still larger than the common jaguar. The black spots are scarcely visible on the dark-brown ground of its skin. The Indians assert, that these tigers are very rare, that they never mingle with the common jaguars, and that they "form another race." I believe that Prince Maximilian of Neuwied, who has enriched American zoology by so many important observations, acquired the same information farther to the south, in the hot part of Brazil. Albino varieties of the jaguar have been seen in Paraguay: for the spots of these animals, which may be called the beautiful panthers of America, are sometimes so pale, as to be scarcely distinguishable on a very white ground. In the black jaguars, on the contrary, it is the colour of the ground which renders the spots indistinct. It requires to reside long in those: countries, and to accompany the Indians of Esmeralda in the perilous chace of the tiger, to decide with certainty upon the varieties and the species. In all the mammifere, and porticularly in the numerous family of the apes, we ought,

[^330]I believe, to fix our attention less on the transition from one colour to another in individuals, than on their habit of scparating themselves, and forming distinct bands.

We left our resting place before sunrise on the 24th of May. In a rocky cove, which had been the dwelling of some Durimundi Indians, the aromatic odour of the plants was so powerful, that although sleeping in the open air, and the irritability of our nervous system being allayed by the habits of a life of fatigue, we were nevertheless incommoded by it. We could not ascertain the flowers which diffused this perfume. The forest was impenetrable; but M. Bonpland believed that large clumps of pancratium and other liliaceous .plants were concealed in the neighbouring marshes. Descending the Orinoco by favour of the current, we passed first the mouth of the Rio Cunuounumo, and then the Guanami and the Puriname. The two banks of the principal river are entirely desert; lofty mountains rise on the north, and on the south a vast plain extends far as the eye can reach beyond the sources of the Atacavi, which lower down takes the name of the Atabapo. There is something gloomy and desolate in this aspect of a river, on which not even a fisherman's canoe is seen. Some independant tribes, the Abirianos and the Maquiritares, dwell in the mountainous country; but in the neighbouring savannahs,* bounded by the Cassiquiare, the Atabapo, the Orinoco, and the Rio Negro, there is now scarcely any trace of a human habitation. I say now; for here, as in other parts of Guiana, rude figures representing the sun, the moon, and different animals, traced on the hardest rocks of granite, attest the anterior existence of a people, very different from those who became known to us on the banks of the Orinoco. According to the accounts of the natives, and of the most intelligent missionaries, these symbolic signs resemble perfectly the characters we saw a hundred leagues more to the north, near Caycara, opposite the mouth of the Rio Apure. $\dagger$

In advancing from the plains of the Cassiquiare and the

[^331]+ See p. 183.

Conorichite, one hundred and forty leagues further eastward, between the sources of the Rio Blanco and the Rio Essequibo, we also meet with rocks and symbolical figures. I have lately verified this curious fact, which is recorded in the journal of the traveller Hortsman, who went up the Rupunuvini, one of the tributary streams of the Essequibo. Where this river, full of small cascades, winds between the mountains of Macarana, he found, before he reached lake Amucu, "rocks covered with figures," or (as he says in Portuguese) with "varias letras." We must not take this word letters in its real signification. We were also shewn, near the rock Culimacari, on the banks of the Cassiquiare, and at the port of Caycara in the Lower Orinoco, traces which were believed to be regular characters. They were however only misshapen figures, representing the heavenly bodies, together with tigers, crocodiles, boas, and instruments used for making the flour of cassava. It was impossible to recognize in these 'painted rocks'* (the name by which the natives denote those masses loaded with figures) any symmetrical arrangement, or characters with regular spaces. The traces discovered in the mountains of Uruana, by the missionary Fray Ramon Bueno, approach nearer to alphabetical writing; but are nevertheless very doubtful.

Whatever may be the meaning of these figures, and with whatever view they were traced upon granite, they merit the examination of those who direct their attention to the philosophic history of our species. In travelling from the coast of Caracas towards the equator, we are at first led to believe that monuments of this kind are peculiar to the mountain-chain of Encaramada; they are found at the port of Sedeño, near Caycara, $\dagger$ at San Rafael del Capuchino, opposite Cabruta, and in almost every place where the granitic rock pierces the soil, in the savannah which extends from the Cerro Curiquima towards the banks of the Caura.

[^332]The nations of the Tamanac race, the ancient inhabitants of those countries, have a local mythology, and traditions connected with these sculptured rocks. Amalivaca, the father of the Tamanacs, that is, the creator of the human race (for every nation regards itself as the root of all other nations), arrived in a bark, at the time of the great inundation, which is called 'the age of water,'* when the billows of the ocean broke against the mountains of Encamarada in the interior of the land. All mankind, or, to speak more correctly, all the Tamanacs, were drowned, with the exception of one man and one woman, who saved themselves on a mountain near the banks of the Asiveru, called Cuchivero by the Spaniards. This mountain is the Ararat of the Aramean or Semitic nations, and the Tlaloc or Colhuacan of the Mexicans. Amalivaca, sailing in his bark, engraved the figures of the moon and the sun on the Painted Rock (Tepumereme) of Encaramada. Some blocks of granite piled upon one another, and forming a kind of cavern, are still called the house or dwelling of the great forefather of the Tamanacs. The natives show also a large stone near this cavern, in the plains of Maita, which they say was an instrument of music, the drum of Amalivaca. We must here observe, that this heroic personage had a brother, Vochi, who helped him to give the surface of the earth its present form. The Tamanacs relate, that the two brothers, in their system of perfectibility, sought, at first, to arrange the Orinoco in such a manner, that the current of the water could always be followed either going down or going up the river. They hoped by this means to spare men trouble in navigating rivers; but, however great the power of these regenerators of the world, they could never contrive to give a double slope to the Orinoco, and were compelled to relinquish this singular plan. Amalivaca had daughters, who had a decided taste for travelling. The tradition states, doubtless with a figurative meaning, that he broke their legs, to render them sedentary, and force them to people the land of the Tamanacs. After having regulated everything in America, on that side of the 'great water,' Amalivaca again embarked, and "returned to the other

[^333]shore," to the same place from whence he came. Since the natives have seen the missionsries arrive, they imagine, that Europe is this 'other shore;' and one of them inquired with great simplicity, of Father Gili, whether he had there seen the great Amalivaca, the father of the Tamanacs, who had covered the rocks with symbolic figures.

These notions of a great convulsion of nature; of two human beings saved on the summit of a mountain, and casting behind them the fruits of the mauritia palm-tree, to repeople the earth; of that national divinity, Amalivaca, who arrived by water from a distant land, who prescribed laws to nature, and forced the nations to renounce their migrations; these various features of a very ancient syatem of belief, are well worthy of attention. What the Tamanace, and the tribes whose languages are analogous to the Tamanar tongue, now relate to us, they have no doubt learned from other people, who inhabited before them the some regions. The name of Amalivaca is spread over a region of more than five thousand square leagues; he is found designated as ' the father of mankind,' or 'our great grandfather,' as far as to the Caribbee nations, whose idiom approaches the Tamanac only in the same degree as the German approaches the Greek, the Persian, and the Sanscrit. Amalivaca is not originally the Great Spirit, the Aged of Heaven, the invisible being, whose worship springs from that of the powers of nature, when nations rise insensibly to the consciousness of the unity of these powers; he is rather a personage of the heroic times, a man, who, coming from afar, lived in the land of the Tamanacs and the Caribs, sculptured symbolic figures upon the rocks, and disappeared by going back to the country he had previously inhabited beyond the ocean. The anthropomorphism of the divinity has two sources diametrically opposite; and this opposition seems to arise less from the various degrees of intellectual culture, than from the different dispositions of nations, some of which are more inclined to mysticism, and others more governed by the senses, and by external impressions. Sometimes man makes the divinities descend upon earth, charging them with the care of ruling nations, and giving them laws, as in the fables of the East; sometimes, as among the Greeks and other nations of the West, they are
the first monarchs, priest-kings, who are stripped of what is human in their nature, to be raised to the rank of national divinities. Amalivaca was a stranger, like Manco-Capac, Bochica, and Quetzalcohuatl; those extraordinary men, who, in the alpine or civilized part of America, on the tablelands of Peru, New Grenada, and Anahuac, organized civil society, regulated the order of sacrifices, and founded religious congregations. The Mexican Quetzalcohuatl, whose descendants Montezuma* thought he recognized in the companions of Cortez, displays an additional resemblance to Amalivaca, the mythologic personage of savage America or the plains of the torrid zone. When advanced in age, the high-priest of Tula left the country of Anahuac, which he had filled with his miracles, to return to an unknown region, called Tlalpallan. When the monk Bernard de Sahagun arrived in Mexico, the same questions were put to him, as those which were addressed to Father Gili two hundred years later, in the forests of the Orinoco; he was asked, whether he came from 'the other shore' (del otro lado), from the countries to which Quetzalcohuatl had retired.

The region of sculptured rocks, or of painted stones, extends far beyond the Lower Orinoco, beyond the country (latitude $7^{\circ} 5^{\prime}$ to $7^{\circ} 40^{\prime}$, longitude $68^{\circ} 50^{\prime}$ to $69^{\circ} 4.5^{\prime}$ ) to which belongs what may be called the 'local fables' of the Tamanacs. We again find these same sculptured rocks between the Cassiquiare and the Atabapo (lat. $2^{\circ} 5^{\prime}$ to $3^{\circ} 20^{\prime}$; long. $69^{\circ}$ to $70^{\circ}$ ); and between the sources of the Essequibo and the Rio Branco (lat. $3^{\circ} 50^{\prime}$; long. $62^{\circ} 32^{\prime}$ ). I do not assert that these figures prove the knowledge of the use of iron, or that they denote a very advanced degree of culture; but even on the supposition that, instead of being symbolical, they are the fruits of the idleness of hunting nations, we must still admit an anterior race of men, very different from those who now inhabit the banks of the Orinoco and the Rupunuri. The more a country is destitute of remembrances of generations that are extinct, the more important it becomes to follow the least traces of what appears to be monumental. The eastern plains of North America display only those extraordinary circum-

* The second king of this name, of the race of Acamapitrin, properly called Monterwme-Ihhuioamina.
vallations, that remind us of the fortified camps (the pretended cities of vast extent) of the ancient and modern nomad tribes of Asia. In the oriental plains of South America, the force of vegetation, the heat of the climate, and the too lavish gifts of nature, have opposed obstacles still more powerful to the progress of human civilization. Between the Orinoco and the Amazon I heard no mention of any wall of earth, vestige of a dyke, or sepulchral tumulus; the rocks alone show us (and this through a great extent of country), rude sketches which the hand of man has traced in times unknown, and which are connected with religious traditions.

Before I quitted the wildest part of the Upper Orinoco, I thought it desirable to mention facts which are important only when they are considered in their connection with each other. All I could relate of our navigation from Esmeralda to the mouth of the Atabapo would be merely an enumeration of rivers and uninhabited places. From the 24th to the 27th of May, we slept but twice on land; our first resting-place was at the confluence of the Rio Jao, and our second below the mission of Santa Barbara, in the island of Minisi. The Orinoco being free from shoals, the Indian pilot pursued his course all night, abandoning the boat to the current of the river. Setting apart the time which we spent on the shore in preparing the rice and plantains that served us for food, we took but thirtyfive hours in going from Esmeralda to Santa Barbara. The chronometer gave me for the longitude of the latter mission $70^{\circ} 3^{\prime}$; we had therefore made near four miles an hour, a velocity which was partly owing to the current, and partly to the action of the oars. The Indians assert, that the crocodiles do not go up the Orinoco above the mouth of the Rio Jao, and that the manatis are not even found above the cataract of Maypures.

The mission of Santa Barbara is situated a little to the west of the mouth of the Rio Ventuari, or Venituari, examined in 1800 by Father Francisco Valor. We found in this small village of one hundred and twenty inhabitants some traces of industry; but the produce of this industry is of little profit to the natives; it is reserved for the monks, or, as they say in these countries, for the church and the con-
vent. We were assured that a great lamp of massive silver, purchased at the expense of the neophytes, is expected from Madrid. Let us hope that, after the arrival of this treasure, they will think also of clothing the Indians, of procuring for them some instruments of agriculture, and assembling their children in a school. Although there are a few oxen in the savannahs round the mission, they are rarely employed in turning the mill (trapiche), to express the juice of the sugar-cane; this is the occupation of the Indians, who work without pay here as they do everywhere when they are understood to work for the church. The pasturages at the foot of the mountains round Santa Barbara are not so rich as at Esmeralda, but superior to those at San Fernando de Atabapo. The grass is short and thick, yet the upper stratum of earth furnishes only a dry and parched granitic saud. The savannahs (far from fertile) of the banks of the Guaviare, the Meta, and the Upper Orinoco, are equally destitute of the mould which abounds in the surrounding forests, and of the thick stratum of clay, which covers the sandstone of the Llanos, or steppes of Venezuela. The small herbaceous mimosas contribute in this zone to fatten the cattle, but are very rare between the Rio Jao and the mouth of the Guaviare.

During the few hours of our stay at the mission of Santa Barbara, we obtained pretty accurate ideas respecting the Rio Ventuari, which, next to the Guaviare, appeared to me to be the most considerable tributary of the Orinoco. Its banks, heretofore occupied by the Maypures, are still peopled by a great number of independent nations. On going up by the mouth of the Ventuari, which forms a delta covered with palm-trees, you find in the east, after three days' journey, the Cumaruita and the Paru, two streams that rise at the foot of the lofty mountains of Cuneva. Higher up, on the west, lie the Mariata and the Manipiare, inhabited by the Macos and Curacicanas. The latter nation is remarkable for their active cultivation of cotton. In a hostile incursion (entrada) a large house was found containing more than thirty or forty hammocks of a very fine texture of spun cotton, cordage, and fishing implements. The natives had fled; and Father Valor informed us, that the Indians of the mission who accompanied him had set fire to
the house before he could save these productions of the industry of the Curacicanas. The neophytes of Santa Barbara, who think themselves very superior to these supposed aavages, appeared to me far less industrious. The Rio Mamipiare, one of the principal branches of the Ventuari, approaches near its source those lofty mountains, the northern ridge of which gives birth to the Cuchivero. It is a prolongation of the chain of Baraguan; and there Father Gili places the table-land of Siamacu, of which he vaunts the temperate climate. The upper course of the Rio Ventuari, beyond the confluence of the Asisi, and the Great Raudales, is almost unknown. I was informed only, that the Upper Ventuari bends so much towards the east that the ancient road from Esmeralda to the Rio Caura crosses the bed of the river. The proximity of the tributary streams of the Carony, the Caura, and the Ventuari, has facilitated for ages the access of the Caribs to the banks of the Upper Orinoco. Bands of this warlike and trading people went up from the Rio Carony, by the Paragua, to the sources of the Paruspa. A portage conducted them to the Chavarro, an eastern tributary stream of the Rio Caura; they descended with their canoes first this stream, and then the Caura itself, as far as the mouth of the Erevato. After having gone up this last river south-west, and traversed vast savannahs for three days, they entered by the Manipiare into the great Rio Ventuari. I trace this road with precision. not only because it was that by which the traffic of native slaves was carried on, but also to call the attention of those, who at some future day may rule the destiny of Guiana, to the high importance of this labyrinth of rivers.

It is by the four largest tributary stream,, which the majestic river of the Orinoco receives on the right, (the Carony, the Caura, the Padamo, and the Ventuari,) that European civilization will one day penetrate into this region of forests and mountains, which has a surface of ten thousand six hundred square leagues, and which is bounded by the Orinoco on the north, the west, and the south. The Capuchins of Catalonia and the Observantins of Andalusia and Valencia, have already made settlements in the vallies of the Carony and the Caura. The tributary streams of the Lower Orinoco, being the nearest to the coast and to the
cultivated region of Venezuela, were naturally the first to receive missionaries, and with them some germs of social life. Corresponding to the Carony and the Caura, which flow toward the north, are two great tributary streams of the Upper Orinoco, that send their waters toward the south; these are the Padamo and the Ventuari. No village has hitherto risen on their banks, though they offer advantages for agriculture and pasturage, which would be sought in vain in the valley of the immense river to which they are tributary. In the centre of these wild countries, where there will long be no other road than the rivers, every project of civilization should be founded on an intimate knowledge of the hydraulic features of the country, and the relative importance of the tributary streams.

In the morning of the 26th of May we left the little village of Santa Barbara, where we found several Indians of Esmeralda, who had come reluctantly, by order of the missionary, to construct for him a house of two stories. During the whole day we enjoyed the view of the fine mountains of Sipapo, which rise at a distance of more than eighteen leagues in the direction of north-north-west. The vegetation of the banks of the Orinoco is singularly varied in this part of the country; the aborescent ferns* descend from the mountains, and mingle with the palm-trees of the plain. We rested that night on the island of Minisi; and, after having passed the mouths of the little rivers Quejanuma, Ubua, and Masao, we arrived, on the 27th of May, at San Fernando de Atabapo. We lodged in the same house which we had occupied a month previously, when going up the Rio Negro. We then directed our course towards the south, by the Atabapo and the Temi; we were now returning from the west, having made a long circuit by the Cassiquiare and the Upper Orinoco.

We remained only one day at San Fernando de Atabapo, although that village, adorned as it was by the pirijao palmtree, with fruit like peaches, appeared to us a delicious

[^334]abode. Tame pauxis* surrounded the Indian huts; in one of which we saw a very rare monkey, which inhabits the banks of the Guaviare. This monkey is the caparro, which I have made known in my "Observations on Zoology and comparative Anatomy;" it forms, as Geoffroy believes, a new genus (Lagothrix) between the ateles and the alouates. The hair of this monkey is grey, like that of the marten, and extremely soft to the touch. The caparro is distinguished by a round head, and a mild and agreeable expression of countenance. I believe the missionary Gili is the only author who has made mention before me of this curious animal, around which zoologists begin to group other monkeys of Brazil. Having quitted San Fernando on the 27th of May, we arrived, by help of the rapid current of the Orinoco, in seven hours, at the mouth of the Rio Mataveni. We passed the night in the open air, under the granitic rock El Castillito, which rises in the middle of the river, and the form of which reminded us of the ruin called the Mouse-tower (Mausethurm), on the Rhine, opposite Bingen. Here, as on the banks of the Atabapo, we were struck by the sight of a small species of drosera, having exactly the appearance of the drosera of Europe.

The Orinoco had sensibly swelled during the night; and the current, strongly accelerated, bore us, in ten hours, from the mouth of the Mataveni to the Upper Great Cataract, that of Maypures, or Quituna. The distance which we passed over was thirteen leagues. We recalled to mind, with much satisfaction, the scenes where we had reposed in going up the river. We again found the Indians who had accompanied us in our herborizations; and we visited anew the fine spring that issues from a rock of stratified granite behind the house of the missionary: its temperature was not changed more than $0.3^{\circ}$. From the mouth of the Atabapo as far as that of the Apure we seemed to be travelling as through a country which we had long inhabited. We were reduced to the same abstinence; we were stung by the same mosquitos; but the certainty of reaching in a few weeks the term of our physical sufferings kept up our spirits.

[^335]The passage of the canoe through the Great Cataract obliged us to stop two days at Maypures. Father Bernardo Zea, missionary at the Raudales, who had accompanied us to the Rio Negro, though ill, insisted on conducting us with his Indians as far as Atures. One of these Indians, Zerepe, the interpreter, who had been so unmercifully punished at the beach of Pararuma, rivetted our attention by his appearance of deep sorrow. We learned that his grief was caused by the loss of a young girl to whom he was engaged, and that he had lost her in consequence of false intelligence which had been spread respecting the direction of our journey. Zerepe, who was a native of Maypures, had been brought up in the woods by his parents, who were of the tribe of the Macos. He had brought with him to the mission a girl of twelve years of age, whom he intended to marry at our return from the Cataracts. The Indian girl was little pleased with the life of the missions, and she was told that the whites would go to the country of the Portuguese (Brazil), and would take Zerepe with them. Disappointed in her hopes, she seized a boat, and with another girl of her own age, crossed the Great Cataract, and fled al monte. The recital of this courageous adventure was the great news of the place. The affliction of Zerepe, however, was not of long duration. Born among the Christians, having travelled as far as the foot of the Rio Negro, understanding Spanish and the language of the Macos, he thought himself superior to the people of his tribe, and he no doubt soon forgot his forest love.

On the 31st of May we passed the rapids of Guahibos and Garcita. The islands which rise in the middle of the waters of the river, were overspread with the purest verdure. The rains of winter had unfolded the spathes of the vadgiai palm-tree, the leaves of which rise straight toward the sky. The eye is never wearied of the view of those scenes, where the trees and rocks give the landscape that grand and severe character which we admire in the background of the pictures of Salvator Rosa. We landed before sunset on the eastern bank of the Orinoco, at the Puerto de la Expedicion, in order to visit the cavern of Ataruipe, which is the place of sepulchre of a whole nation destroyed. I shall attempt to describe this cavern, so celebrated among the natives.
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We clumbed with difficulty, and not without some danger, a steep rock of granite, entirely bare. It would have been almost impossible to fix the foot on its smooth and sloping surface, if large crystals of feldspar, resisting decomposition, did not stand out from the rock, and furnish points of support. Scarcely had we attained the summit of the mountain when we beheld with astonishment the singular aspect of the surrounding country. The foamy bed of the waters is filled with an archipelago of islands covered with palmtrees. Westward, on the left bank of the Orinoco, the wide-stretching savannahs of the Meta and the Casansre resembled a sea of verdure. The setting sun seemed like a globe of fire suspended over the plain, and the solitary Peak of Uniana, which appeared more lofty from being wrapped in vapours which softened its outline, all contributed to augment the majesty of the scene. Immediately below us lay a deep valley, enclosed on every side. Birds of prey and goatsuckers winged their lonely flight in this inaccessible circus. We found a pleasure in following with the eye their fleeting shadows, as they glided slowly over the flanks of the rock.

A narrow ridge led us to a neighbouring mountain, the rounded summit of which supported immense blocks of granite. These massen are more than forty or fifty feet in diameter; and their form is so perfectly spherical, that, as they appear to touch the soil only by a small number of points, it might be supposed, at the least shock of an earthquake, they would roll into the abyss. I do not remember to have seen any where else a similar phenomenon, amid the decompositions of granitic soils. If the balls rested on a rock of a different nature, as in the blocks of Jura, we might suppose that they had been rounded by the action of water, or thrown out by the force of an elastic fluid; but their position on the summit of a hill alike granitic, makes it more probable that they owe their origin to the progressive decomposition of the rock.

The most remote part of the valley is covered by a thick forest. In this shady and solitary spot, on the declivity of a steep mountain, the cavern of Ataruipe opens to the view. It is less a cavern than a jutting rock, in which the waters have scooped a vast hollow when, in the ancient revolutions

Original from
of our planet, they attained that height.* In this tomb of a whole extinct tribe we soon counted nearly six hundred skeletons well preserved, and regularly placed. Every skeleton reposes in a sort of basket made of the petioles of the palm-tree. These baskets, which the natives call mapires, have the form of a square bag. Their size is proportioned to the age of the dead; there are some for infants cut off at the moment of their birth. We saw them from ten inches to three feet four inches long, the skeletons in them being bent together. They are all ranged near each other, and are so entire that not a rib or a phalanx is wanting. The bones have been prepared in three different manners, either whitened in the air and the sun, dyed red with anoto, or, like mummies, varnished with odoriferous resins, and enveloped in leaves of the heliconia or of the plantain-tree. The Indians informed us that the fresh corpse is placed in damp ground, that the flesh may be consumed by degrees; some months afterwards it is taken out, and the flesh remaining on the bones is scraped off with sharp stones. Several hordes in Guiana still observe this custom. Earthen vases half-baked are found near the mapires or baskets. They appear to contain the bones of the same family. The largest of these vases, or funeral urns, are five feet high, and three feet three inches long. Their colour is greenish-grey, and their oval form is pleasing to the eye. The handles are made ir the shape of crocodiles or serpents; the edges are bordered with painted meanders, labyrinths, and grecques, in rows variously combined. Such designs are found in every zone among nations the farthest removed from each other, either with respect to their respective positions on the globe, or to the degree of civilization which they have attained. They still adorn the common pottery made by the inhabitants of the little mission of Maypures; they ornament the bucklers of the Otaheitans, the fishing-implements of the Esquimaux,

[^336]the walls of the Mexican palace of Mitla, and the vases of ancient Greece.

We could not acquire any precise idea of the period to which the origin of the mapires and the painted vases, contained in the bone-cavern of Ataruipe, can be traced. The greater part seemed not to be more than a century old; but it may be supposed that, sheltered from all humidity under the influence of a uniform temperature, the preservation of these articles would be no less perfect if their origin dated from a period far more remote. A tradition circulates among the Guahibos, that the warlike Atures, pursued by the Caribs, escaped to the rocks that rise in the middle of the Great Cataracts; and there that nation, heretofore so numerous, became gradually extinct, as well as its language. The last families of the Atures still existed in 1767, in the time of the missionary Gili. At the period of our voyage an old parrot was shown at Maypures, of which the inhabitants said, and the fact is worthy of observation, that "they did not understand what it said, because it spoke the language of the Atures."

We opened, to the great concern of our guides, several mapires, for the purpose of examining attentively the form of the skulls. They were all marked by the characteristics of the American race, with the exception of two or three, which approached indubitably to the Caucasian. In the middle of the Cataracts, in the most inaccessible spots, cases are found strengthened with iron bands, and filled with European tools, vestiges of clothes, and glass trinkets. These articles, which have given rise to the most absurd reports of treasures hidden by the Jesuits, probably belonged to Portuguese traders who had penetrated into these savage countries. May we suppose that the skulls of European race, which we saw mingled with the skeletons of the natives, and preserved with the same care, were the remains of some Portuguese travellers who had died of sickness, or had been killed in battle? The aversion evinced by the natives for whatever is not of their own race renders this hypothesis little probable. Perhaps fugitive mestizos of the missions of the Meta and Apure may have come and settled near the Cataracts, marrying
women of the tribe of the Atures. Such mixed marriages sometimes take place in this zone, though they are more rare than in Canada, and in the whole of North America, where hunters of European origin unite themselves with savages, assume their habits, and sometimes acquire great political influence.

We took several skulls, the skeleton of a child of six or seven years old, and two of full-grown men of the nation of the Atures, from the cavern of Ataruipe. All these bones, partly painted red, partly varnished with odoriferous resins, were placed in the baskets (mapires or canastos) which we have just described. They made almost the whole load of a mule; and as we knew the superstitious feelings of the Indians in reference to the remains of the dead after burial, we carefully enveloped the canastos in mats recently woven. Unfortunately for us, the penetration of the Indians, and the extreme quickness of their sense of smelling, rendered all our precautions useless. Wherever we stopped, in the missions of the Caribbees, amid the Llanos, between Angostura and Nueva Barcelona, the natives assembled round our mules to admire the monkeys which we had purchased at the Orinoco. These good people had scarcely touched our baggege, when they announced the approaching death of the beast of burden "that carried the dead." In vain we told them that they were deceived in ther conjectures; and that the baskets contained the bones of crocodiles and manatis; they persisted in repeating that they smelt the resin that surrounded the skeletons, and "that they were their old relations." We were obliged to request that the monks would interpose their authority, to overcome the aversion of the natives, and procure for us a change of mules.

One of the skulls, which we took from the cavern of Ataruipe, has appeared in the fine work published by my old master, Blumenbach, on the varieties of the human species. The skeletons of the Indians were lost on the coast of Africa, together with a considerable part of our collections, in a shipwreck, in which perished our friend and fellow-traveller, Fray Juan Gonzales, the young monk of the order of Saint Francis.

We withdrew in silence from the cavern of Ataruipe.

It was one of those calm and serene nights which are so common in the torrid zone. The stars shone with a mild and planetary light. Their scintillation was scarcely sensible at the horizon, which seemed illumined by the great ncbulm of the southern hemisphere. An innumerable multitude of insects spread a reddish light upon the ground, loaded with plants, and resplendent with these living and moving fires, as if the stars of the firmament had sunk down on the savannah. On quitting the cavern we stopped several times to admire the beauty of this singular scene. The odoriferous vanilla and festoons of bignonia decorated the entrance; and above, on the summit of the hill, the arrowy branches of the palm-trees waved murmuring in the air. We descended towards the river, to take the road to the mission, where we arrived late in the night. Our imagination was struck by all we had just seen. Occupied continually by the present, in a country where the traveller is tempted to regard human society as a new institution, he is more powerfully interested by remembrances of times past. These remembrances were not indeed of a distant date; but in all that is monumental antiquity is a relative idea, and we easily confound what is ancient with what is obscure and problematic. The Egyptians considered the historical remembrances of the Greeks as very recent. If the Chinese, or, as they prefer calling themselves, the inhabitants of the Celestial Empire, could have communicated with the priests of Heliopolis, they would have smiled at those pretensions of the Egyptians to antiquity. Contrasts not less striking are found in the north of Europe and of Asia, in the New World, and in every region where the human race has not preserved a long consciousness of itself. The migration of the Toltecs, the most ancient historical event on the tableland of Mexico, dates only in the sixth century of our era. The introduction of a good system of intercalation, and the reform of the calendars, the indispensable basis of an accurate chronology, took place in the year 1091. These epochs, which to us appear so modern, fall on fabulous times, when we reflect on the history of our species between the banks of the Orinoco and the Amazon. We there see symbolic figures sculptured on the rocks, but no tradition
throws light upon their origin. In the hot part of Guiana we can go back only to the period when the Castilian and Portuguese conquerors, and more recently peaceful monks, penetrated amid so many barbarous nations.

It appears, that, to the north of the Cataracts, in the strait of Baraguan, there are caverns filled with bones, similar to those I have just described: but I was informed of this fact only after my return; our Indian pilots did not mention it when we landed at the strait. These tombs no doubt have given rise to a fable of the Ottomacs, according to which the granitic and solitary rocks of Baraguan, the forms of which are very singular, are regarded as the 'grandfathers,' the 'ancient chiefts' of the tribe. The custom of separating the flesh from the bones, very anciently practised by the Massagetes, is still known among several hordes of the Orinoco. It is even asserted, and with some probability, that the Guaraons plunge their dead bodies under water enveloped in nets; and, that the small caribe-fishes, of which we saw everywhere an innumerable quantity, devour in a few days the muscular flesh, and thus prepare the skeleton. It may be supposed, that this operation can be practised only in places where crocodiles are not common. Some tribes, for instance the Tamanacs, are accustomed to lay waste the fields of a deceased relative, and cut down the trees which he has planted. They say, "that the signt of objects, which belonged to their relation, makes them melancholy." They like better to efface than to preserve remembrances. These effects of Indian sensibility are very detrimental to agriculture, and the monks oppose with energy these superstitious practices, to which the natives converted to Christianity still adhere in the missions.

The tombs of the Indians of the Orinoco have not been very closely examined, because they do not contain valuable articles like those of Peru; and even on the spot no faith is now lent to the chimerical ideas, which were heretofore formed of the wealth of the ancient inhabitants of El Dorado. The thirst of gold everywhere precedes the desire of instruction, and a taste for researches into antiquity; in all the mountainous part of South America, from Merida and Santa Marta to the table-lands of Quito and Upper Peru, the labours of absolute mining have been undertalken to discover
tombs, or, as the Creoles say, employing a word altered from the Inca language, guacas. When in Peru, at Mancichi, I went into the guaca, from which, in the sixteenth century, masses of gold of great value were extracted. No trace of the precious metals has been found in the caverns which have served the natives of Guiana for ages as sepulchres. This circumstance proves, that, even at the period when the Caribs, and other travelling nations, made incursions to the south-west, gold had flowed in very small quantities from the mountains of Peru towards the eastern plains.

Wherever the granitic rocks do not present any of those large cavities caused by their decomposition, or by an accumulation of their blocks, the Indians deposit their dead in the earth. The hammock (chinchorro), a kind of net in which the deceased had reposed during his life, serves for a coffin. This net is fastened tight round the body, a hole is dug in the hut, and there the body is laid. This is the most usual method, according to the account of the missionary Gili, and it accords with what I myself learned from Father Zea. I do not believe that there exists one tumulus in Guiana, not even in the plains of the Cassiquiare and the Essequibo. Some, however, are to be met with in the savannahs of Varinas, as in Canada, to the west of the Alleghanies.* It seems remarkable enough that, notwithstanding the extreme abundance of wood in those countries, the natives of the Orinoco were as little accustomed as the ancient Scythians to burn the dead. Sometimes they formed funeral piles for that purpose; but only after a battle, when the number of the dead was considerable. In 1748, the Parecas burned not only the bodies of their enemies, the Tamanacs, but also those of their own people who fell on the field of battle. The Indians of South America, like all nations in a state of nature, are strongly attached to the spots where the bones of their fathers repqse. This feeling, which a great writer has beautifully painted in the episode of Atala, is cherished in all its primitive ardour by the Chinese. These people,

[^337]among whom everything is the produce of art, or rather of the most ancient civilization, do not change their dwelling without carrying along with them the bones of their ancestors. Coffins are seen deposited on the banks of great rivers, to be transported, with the furniture of the family, to a remote province. These removals of bones, heretofore more common among the savages of North America, are not practised among the tribes of Guiana; but these are not nomad, like nations who live exclusively by hunting.

We staid at the mission of Atures only during the time necessary for passing the canoe through the Great Cataract. The bottom of our trail bark had become so thin that it required great care to prevent it from splitting. We took leave of the missionary, Bernardo Zea, who remained at Atures, after having accompanied us during two months, and shared all our sufferings. This poor monk still continued to have fits of tertian ague; they had become to him an habitual evil, to which he paid little attention. Other fevers of a more fatal kind prevailed at Atures on our second visit. The greater part of the Indians could not leave their hammocks, and we were obliged to send in search of cassavabread, the most indispensable food of the country, to the independent but neighbouring tribe of the Piraoas. We had hitherto escaped these malignant fevers, which, I believe to be always contagious.

We ventured to pass in our canoe through the latter half of the Raudal of Atures. We landed here and there, to climb upon the rocks, which like narrow dikes joined the islands to one another. Sometimes the waters force their way orer the dikes, sometimes they fall within them with a hollow noise. A considerable portion of the Orinoco was dry, because the river had found an issue by subterraneous caverns. In these solitary haunts the rock-manakin with gilded plumage (Pipra rupicola), one of the most beautiful birds of the tropics, builds its nest. The Raudalito of Carucari is caused by an accumulation of enormous blocks of granite, several of which are spheroids of five or six feet in diameter, and they are piled together in such a manner, as to form spacious caverns. We entered one of these caverns to gather the confervas that were spread over the
clefts and humid sides of the rock. This spot displayed one of the most extraordinary scenes of nature, that we had contemplated on the banks of the Orinoco. The river rolled its waters turbulently over our heads. It seemed like the sea dashing against reefs of rocks; but at the entrance of the cavern we could remain dry beneath a large sheet of water that precipitated itself in an arch from above the barrier. In other cavities, deeper, but less spacious, the rock was pierced by the effect of successive filtrations. We saw columns of water, eight or nine inches broad, descending from the top of the vault, and finding an issue by clefts, that seemed to communicate at great distances with each other.

The cascades of Europe, forming only one fall, or several falls close to each other, can never produce such variety in the shifting landscape. This variety is peculiar to rapids, to a succession of small cataracts several miles in length, to rivers that force their way across rocky dikes and accumulated blocks of granite. We had the opportunity of viewing this extraordinary sight longer than we wished. Our boat was to coast the eastern bank of a narrow island, and to take us in again after a long circuit. We passed an hour and a half in vain expectation of it. Night approached, and with it a tremendous storm. It rained with violence. We began to fear that our frail bark had been wrecked against the rocks, and that the Indians, conformably to their habitual indifference for the evils of others, had returned tranquilly to the mission. There were only three of us: we were completely wet, and uneasy respecting the fate of our boat: it appeared far from agreeable to pass, without sleep, a long night of the torrid zone, amid the noise of the Raudales. M. Bonpland proposed to leave me in the island with Don Nicolas Soto, and to swim across the branches of the river, that are separated by the granitic dikes. He hoped to reach the forest, and seek assistance at Atures from Father Zea. We dissuaded him with difficulty from undertaking this hazardous enterprise. He knew little of the labyrinth of small channels, into which the Orinoco is divided. Most of them have strong whirlpools, and what passed before our eyes, while we were deliberating on our situation, proved sufficiently, that the natives had deceived us respecting the absence of crocodiles in the
cataracts. The little monkeys which we had carried along with us for months, were deposited on the point of our island. Wet by the rains, and sensible of the least lowering of the temperature, these delicate animals sent forth plaintive cries, and attracted to the spot two crocodiles, the size and leaden colour of which denoted their great age. Their unexpected appearance made us reflect on the danger we had incurred by bathing, at our first passing by the mission of Atures, in the middle of the Raudal. After long waiting, the Indians at length arrived at the close of day. The natural coffer-dam, by which they had endeavoured to descend, in order to make the circuit of the island, had become impassable, owing to the shallowness of the water. The pilot sought long for a more accessible passage in this labyrinth of rocks and islands. Happily our canoe was not damaged, and in less than half an hour our instruments, provision, and animals, were embarked.

We pursued our course during a part of the night, to pitch our tent again in the island of Panumana. We recognized with pleasure the spots where we had botanized when going up the Orinoco. We examined once more on the beach of Guachaco that small formation of sandstone, which reposes directly on granite. Its position is the same as that of the sandstone which Burckhardt observed at the entrance of Nubia, superimposed on the granite of Syene. We passed, without visiting it, the new mission of San Borga, where (as we learned with regret a few days after) the little colony of Guahibos had fled al monte, from the chimerical fear that we should carry them off, to sell them as poitos, or slaves. After having passed the rapids of Tabaje, and the Raudal of Cariven. near the mouth of the great Rio Meta, we arrived without accident at Carichana. The missionary received us with that kind hospitality which he extended to us on our first passage. The sky was unfavourable for astronomical observations; we had obtained some new ones in the two Great Cataracts; but thence, as far as the mouth of the Apure, we were obliged to renounce the attempt. M. Bonpland had the satisfaction at Carichana of dissecting a manati more than nine feet long. It was a female, and the flesh appeared to us not unsavoury. I have spoken in another place of the
manner of catching this herbivorous cetacea. The Piraoas, some families of whom inhabit the mission of Carichana, detest this animal to such a degree, that they hid themselves, to avoid being obliged to touch it, whilst it was being conveyed to our hut. They said, that the people of their tribe die infallibly, when they eat of it. This prejudice is the more singular, as the neighbours of the Piraoas, the Guamos and the Ottomacs, are very fond of the flesh of the manati. The flesh of the crocodile is also an object of horror to some tribes, and of predilection to others.

The island of Cuba furnishes a fact little known in the history of the manati. South of the port of Xagua, several miles from the coast, there are springs of fresh water in the middle of the sea. They are supposed to be owing to a hydrostatic pressure existing in subterraneous channels, communicating with the lofty mountains of Trinidad. `Small vessels sometimes take in water there; and, what is well worthy of observation, large manatis remain habitually in those spots. I have already called the attention of naturalists to the crocodiles which advance from the mouth of rivers far into the sea. Analogous circumstances may have caused, in the ancient catastrophes of our planet, that singular mixture of pelagian and fluviatile bones and petrifactions, which is observed in some rocks of recent formation.

Our stay at Carichana was very useful in recruiting our strength after our fatigues. M. Bonpland bore with him the germs of a cruel malady; he needed repose; but as the delta of the tributary streams included between the Horeda and Paruasi is covered with a rich vegetation, he made long herbalizations, and was wet through several times in a day. We found, fortunately, in the house of the missionary, the most attentive care; we were supplied with bread made of maize flour, and even with milk. The cows yield milk plentifully enough in the lower regions of the torrid zone, wherever good pasturage is found. I call attention to this fact, because local circumstances have spread through the Indian Archipelago the prejudice of considering hot climates as repugnant to the secretion of milk. We may conceive the indifference of the inhabitants of the New World for a milk diet, the country having been originally
destitute of animals capable of furnishing it*; but how can we avoid being astonished at this indifference in the immense Chinese population, living in great part beyond the tropics, and in the same latitude with the nomad and pastoral tribes of central Asia? If the Chinese have ever been a pastoral people, how have they lost the tastes and habits so intimately connected with that state, which precedes agricultural institutions? These questions are interesting with respect both to the history of the nations of oriental Asia, and to the ancient communications that are supposed to have existed between that part of the world and the north of Mexico.

We went down the Orinoco in two days, from Carichana to the mission of Uruana, after having again passed the celebrated strait of Baraguan. We stopped several times to determine the velocity of the river, and its temperature at the surface, which was $27 \cdot 4^{\circ}$. The velocity was found to be two feet in a second (sixty-two toises in $3^{\prime} 6^{\prime \prime}$ ), in places where the bed of the Orinoco was more than twelve thousand feet broad, and from ten to twelve fathoms deep. The slope of the river is in fact extremely gentle from the Great Cataracts to Angostura; and, if a barometric measurement were wanting, the difference of height might be determined by approximation, by measuring from time to time the velocity of the stream, and the extent of the section in breadth and depth. We had some observations of the stars at Uruana. I found the latitude of the mission to be $7^{\circ}$ $8^{\prime}$; but the results from different stars left a doubt of more than $1^{\prime}$. The stratum of mosquitos, which hovered over the ground, was so thick that I could not succeed in rectifying properly the artificial horizon. I tormented my-

[^338]self in vain; and regretted that I was not provided with a mercurial horizon. On the 7th of June, good absolute altitudes of the sun gave me $69^{\circ} 40^{\prime}$ for the longitude. We had advanced from Esmeralda $1^{\circ} 17^{\prime}$ toward the west, and this chronometric determination merits entire confidence on on account of the double observations, made in going and returning, at the Great Cataracts, and at the confluence of the Atabapo and of the Apure.

The situation of the mission of Uruana is extremely picturesque. The little Indian village stands at the foot of a lofty granitic mountain. Rocks everywhere appear in the form of pillars above the forest, rising higher than the tops of the tallest trees. The aspect of the Orinoco is nowhere more majestic, than when newed from the hut of the missionary, Fray Ramon Bueno. It is more than two thousand six hundred toises broad, and it runs without any winding, like a vast canal, straight toward the east. Two long and narrow islands (Isla de Uruana and Isla vieja de la Manteca) contribute to give extent to the bed of the river; the two banks are parallel, and we cannot call it divided into different branches. The mission is inhabited by the Ottomacs, a tribe in the rudest state, and presenting one of the most extraordinary physiological phenomena. They eat earth; that is, they swallow every day, during several months, very considerable quantities, to appease hunger, and this practice does not appear to have any injurious effect on their health. Though we could stay only one day at Uruana, this short space of time sufficed to make us acquainted with the preparation of the poya, or balls of earth. I also found some traces of this vitiated appetite among the Guamos; and between the confluence of the Meta and the Apure, where everybody speaks of dirt-eating as of a thing anciently known. I shall here confine myself to an account of what we ourselves saw or heard from the missionary, who had been doomed to live for twelve years among the savage and turbulent tribe of the Ottomacs.

The inhabitants of Cruana belong to those nations of the savannahs called wandering Indians (Indios andantes), who, more difficult to civilize than the nations of the forest (Indios del monte), have a decided aversion to cultivate the land, and live almost exclusively by hunting and fishing.

They are men of very robust constitution; but ill-looking, savage, vindictive, and passionately fond of fermented liquors. They are omnivorous animals in the highest degree; and therefore the other Indians, who consider them as barbarians, have a common saying, "nothing is so loathsome but that an Ottomac will eat it." While the waters of the Orinoco and its tributary streams are low, the Ottomacs subsist on fish and turtles. The former they kill with surprising dexterity, by shooting them with an arrow when they appear at the surface of the water. When the rivers swell tishing almost entirely ceases.* It is then very difficult to procure fish, which often fails the poor missionaries, on fast-days as well as flesh-days, though all the young Indians are under the obligation of " fishing for the convent." During the period of these inundations, which last two or three months, the Ottomacs swallow a prodigious quantity of earth. We found heaps of earth-balls in their huts, piled up in pyramids three or four feet high. These balls were five or six inches in diameter. The earth which the Ottomacs eat, is a very fine and unctuous clay, of a yellowish grey colour; and, when being slightly baked at the fire, the hardened crust has a tint inclining to red, owing to the oxide of iron which is mingled with it. We brought away some of this earth, which we took from the winter-provision of the Indians; and it is a mistake to suppose that it is steatitic, and that it contains magnesia. Vauquelin did not discover any traces of that substance in it: but he found that it contained more silex than alumina, and three or four per cent of lime.

The Ottomacs do not eat every kind of clay indifferently; they choose the alluvial beds or strata, which contain the most unctuous earth, and the smoothest to the touch. I inquired of the missionary whether the moistened clay were made to undergo that peculiar decomposition which is indicated by a disengagement of carbonic acid and sulphuretted hydrogen, and which is designated in every language by the term of putrefaction; but he assured us, that the natives neither cause the clay to rot, nor do they mingle it with

[^339]flour of maize, oil of turtle's eggs, or fat of the crocodile. We ourselves examined, bnth at the Orinoco and after our return to Paris, the balls of earth which we brought away with us, and found no trace of the mixture of any organic substance, whether oily or farinaceous. The savage regards every thing as nourishing that appeases hunger: when, therefore, you inquire of an Ottomac on what he subsists during the two months when the river is at its highest flood he shows you his balls of clayey earth. This he calls his principal food at the period when he can seldom procure a lizard, a root of fern, or a dead fish swimming at the surface of the water. If necessity force the Indians to eat earth during two months (and from three quarters to five quarters of a pound in twenty-four hours), he eats it from choice during the rest of the year. Every day in the seasou of drought, when fishing is most abundant, he scrapes his balls of poya, and mingles a little clay with his other aliment. It is most surprising that the Ottomacs do not become lean by swallowing such quantities of earth: they are, on the contrary, extremely robust. The missionary Fray Ramon Bueno asserts, that he never remarked any alteration in the health of the natives at the period of the great risings of the Orinoco.

The Ottomacs during some months eat daily three-quarters of a pound of clay slightly hardened by fire, but which they moisten before swallowing it. It has not been possible to verify hitherto with precision how much nutritious vegetable or animal matter they take in a week at the same time; but they attribute the sensation of satiety which they feel, to the clay, and not to the wretched aliments which they take with it occasionally.
No physiological phenomenon being entirely insulated, it may be interesting to examine several analogous phenomena, which I have been able to collect. I observed everywhere within the torrid zone, in a great number of individuals, children, women, and sometimes even full-grown men, an inordinate and almost irresistible desire of swallowing earth; not an alkaline or calcareous earth, to neutralize (as it is said) acid juices, but a fat clay, unctuous, and exhaling a strong smell. It is often found necessary to tie the children's hands or to confine them, to prevent their eating earth,
when the rain ceases to fall. At the village of Banco, on the bank of the river Magdalena, I saw the Indian women who make pottery continually swallowing great pieces of clay. These women were not in a state of pregnancy; and they affirmed, that earth is an aliment which they do not find hurtful. In other American tribes, people soon fall sick, and waste away, when they yield too much to this mania of eating earth. We found at the mission of San Borja an Indian child of the- Guahiba nation, who was as thin as a skeleton. The mother informed us that the little girl was reduced to this lamentable state of atrophy in consequence of a disordered appetite, she having refused during four months to take almost any other food than clay. Yet San Borja is only twenty-five leagues distant from the mission of Uruana, inhabited by that tribe of the Ottomacs, who, from the effect no doubt of a habit progressively acquired, swallow the poya without experiencing any pernicious effects. Father Gumilla asserts, that the Ottomacs take as an aperient, oil, or rather the melted fat of the crocodile, when they feel any gastric obstructions; but the missionary whom we found among them was little disposed to confirm this assertion. It may be asked, why the mania of eating earth is much more rare in the frigid and temperate than in the torrid zones; and why in Europe it is found only among women in a state of pregnancy, and sickly children. This difference between hot and temperate climates arises perhaps only from the inert state of the functions of the stomach, caused by strong cutaneous perspiration. It has been supposed to be observed, that the inordinate taste for eating earth augments among the African slaves, and becomes more pernicious, when they are restricted to a regimen purely vegetable and deprived of spirituous liquors.

The negroes on the coast of Guinea delight in eating a yellowish earth, which they call caouac. The slaves who are taken to America endeavour to indulge in this habit; but it proves detrimental to their health. They say, that the earth of the West Indies is not so easy of digestion as that of their country." Thibaut de Chanvalon, in his Voyage to Martinico, expresses himself very judiciously on this pathological phenomenon. "Another cause," he says," of this pain in the stomach is, that several of the negroes, who come
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from the coast of Guinea, eat earth; not from a depraved taste, or in consequence of disease, but from a habit contracted at home in Africa, where they eat, they say, a particular earth, the taste of which they find agreeable, without suffering any inconvenience. They seek in our islands for the earth most similar to this, and prefer a yellowish red volcanic tufa. It is sold secretly in our public markets; but this is an abuse which the police ought to correct. The negroes who have this habit are so fond of caouac, that no chastisement will prevent their eating it."

In the Indian Archipelago, at the island of Java, Labillardière saw, between Surabaya and Samarang, little square and reddish cakes exposed for sale. These cakes called tanaampo, were cakes of clay, slightly baked, which the natives eat with relish. The attention of physiologists, since my return from the Orinoco, having been powerfully directed to these phenomena of geophagy, M. Leschenault,
(one of the naturalists of the expedition to the Antartic regions under the command of captain Baudin) has published some curious details on the tanaampo, or ampo, of the Javanese. "The reddish and somewhat ferruginous clay," he says " which the inhabitants of Java are fond of eating occasionally, is spread on a plate of iron, and baked, after having been rolled into little cylinders in the form of the bark of cinnamon. In this state it takes the name of ampo, and is sold in the public markets. This clay has a peculiar taste, which is owing to the baking: it is very absorbent, and adheres to the tongue, which it dries. In general it is only the Javanese women who eat the ampo, either in the time of pregnancy, or in order to grow thin; the absence of plumpness being there regarded as a kind of beauty. The use of this earth is fatal to health; the women lose their appetite imperceptibly, and take only with relish a very small quantity of food; but the desire of becoming thin, and of preserving a slender shape, induces them to brave these dangers, and maintains the credit of the ampo." The savage inhabitants of New Caledonia also, to appease their hunger in times of scarcity, eat great pieces of a friable Lapis ollaris. Vauquelin analysed this stone, and found in it, beside magnesia and silex in equal portions, a small quantity of oxide of copper. M. Goldberry had seen the negroes in

Africa, in the islands of Bunck and Los Idolos, eat a earth of which he had himself eaten, without being incommoded by it, and which also was a white and friable steatite. These examples of earth-eating in the torrid zone appear very strange. We are struck by the anomaly of finding a taste, which might seem to belong only to the inhabitants of the most sterile regions, prevailing among races of rude and indolent men, who live in the finest and most fertile countries on the globe. We saw at Popayan, and in several mountainous parts of Peru, lime reduced to a very fine powder, sold in the public markets to the natives among other articles of food. This powder, when eaten, is mingled with coca, that is, with the leaves of the Erythroxylon peruvianum. It is well known, that Indian messengers take no other aliment for whole days than lime and coca: both excite the secretion of saliva, and of the gastric juice; they take away the appetite, without affording any nourishment to the body. In other parts of South America, on the coast of Rio de la Hacha, the Guajiros swallow lime alone, without adding any vegetable matter to it. They carry with them a little box filled with lime, as we do snuff-boxes, and as in Asia people carry a betel-box. This American custom excited the curiosity of the first Spanish navigators. Lime blackens the teeth; and in the Indian Archipelago, as among several American hordes, to blacken the teeth is to beautify them. In the cold regions of the kingdom of Quito, the natives of Tigua eat habitually from choice, and without any injurious consequences, a very fine clay, mixed with quartzose sand. This clay, suspended in water, renders it milky. We find in their huts large vessels filled with this water, which serves as a beverage, and which the Indians call agua or leche de llanka.*

When we reflect on these facts, we perceive that the appetite for clayey, magnesian, and calcareous earth is most common among the people of the torrid zone; that it is not always a cause of disease; and that some tribes eat earth from choice, whilst others (as the Ottomacs in America, and the inhabitants of New Caledonia, in the Pacific) eat it from want, and to appease hunger. A great number of

* Water or milk of clay. Llanka is a word of the general language of the Incas, signifying fine clay.
physiological phenomena prove that a temporary cessation of hunger may be produced though the substances that are submitted to the organs of digestion may not be, properly speaking, nutritive. The earth of the Ottomacs, composed of alumine and silex, furnishes probably nothing, or almost nothing, to the composition of the organs of man. These organs contain lime and magnesia in the bones, in the lymph of the thoracic duct, in the colouring matter of the blood, and in white hairs; they afford very small quantities of silex in black hair; and, according to Vauquelin, but a few atoms of alumine in the bones, though this is contained abundantly in the greater part of those vegetable substances which form part of our nourishment. It is not the same with man as with animated beings placed lower in the scale of organization. In the former, assimilation is exerted only on those substances that enter essentially into the composition of the bones, the muscles, and the medullary matter of the nerves and the brain. Plants, on the contrary, draw from the soil the salts that are found accidentally mixed in it; and their fibrous texture varies according to the nature of the earths that predominate in the spots which they inhabit. An object well worthy of research, and which has long fixed my attention, is the small number of simple substances (earthy and metallic) that enter into the composition of animated beings, and which alone appear fitted to maintain what we may call the chemical movement of vitality.

We must not confound the sensations of hunger with that vague feeling of debility which is produced by want of nutrition, and by other pathologic causes. The sensation of hunger ceases long before digestion takes place, or the chyme is converted into chyle. It ceases either by a nervous and tonic impression exerted by the aliments on the coats of the stomach; or, because the digestive apparatus is filled with substances that excite the mucous membranes to an abundant secretion of the gastric juice. To this tonic impression on the nerves of the stomach the prompt and salutary effects of what are called nutritive medicaments may be attributed, such as chocolate, and every substance that gently stimulates and nourishes at the same time. It is the absence of a nervous stimulant
that renders the solitary use of a nutritive substance (as starch, gum, or sugar) less favourable to assimilation, and to the reparation of the losses which the human body undergoes. Opium, which is not nutritive, is employed with success in Asia, in times of great scarcity; it acts as a tonic. But when the matter which fills the stomach can be regarded neither as an aliment, that is, as proper to be assimilated, nor as a tonic stimulating the nerves, the cessation of hunger is probably owing only to the secretion of the gastric juice. We here touch upon a problem of physiology which has not been sufficiently investigated. Hunger is appeased, the painful feeling of inanition ceases, when the stomach is filled. It is said that this viscus stands in need of ballast; and every language furnishes figurative expressions, which convey the idea that a mechanical distension of the stomach causes an agreeable sensation. Recent works of physiology still speak of the painful contraction which the stomach experiences during hunger, the friction of its sides against one another, and the action of the gastric juice on the texture of the digestive apparatus. The observations of Bichat, and more particularly the fine experiments of Majendie, are in contradiction to these superannuated hypotheses. After twentyfour, forty-eight, or even sixty hours of abstinence, no contraction of the stomach is observed; it is only on the fourth or fifth day that this organ appears to change in a small degree its dimensions. The quantity of the gastric juice diminishes with the duration of abstinence. It is probable that this juice, far from accumulating, is digested as an alimentary substance. If a cat or dog be made to swallow a substance which is not susceptible of being digested, a pebble for instance, a mucous and acid liquid is formed abundantly in the cavity of the stomach, somewhat resembling in its composition the gastric juice of the human body. It appears to me very probable, that when the want of aliments compels the Ottomacs and the inhabitants of New Caledonia to swallow clay and steatite during a part of the year, these earths occasion a powerful secretion of the gastric and pancreatic juices in the digestive apparatus of these people. The observations which I made on the banks of the Orinoco, have been recently confirmed
by the direct experiments of two distinguished young physiologists, MM. Cloquet and Breschet. After long fasting they ate as much as five ounces of a silvery green and very flexible laminar talc. Their hunger was completely satisfied, and they felt no inconvenience from a kind of food to which their organs were unaccustomed. It is known that great use is still made in the East of the bolar and sigillated earths of Lemnos, which are clay mingled with oxide of iron. In Germany, the workmen employed in the quarries of sandstone worked at the mountain of Kiffhauser spread a very fine clay upon their bread, instead of butter, which they call steinbutter* (stone-butter).

The state of perfect health enjoyed by the Ottomaes during the time when they use little muscular exercise, and are subjected to so extraordinary a regimen, is a phenomenon difficult to be explained. It can be attributed onlyto a.habit, prolonged from generation to generation. The structure of the digestive apparatus differs much in animals that feed exclusively on flesh or on seeds; it is even probable that the gastric juice changes its nature, according as it is employed in effecting the digestion of animal or vegetable substances; yet we are able gradually to change the regimen of herbivorous and carnivorous animals, to feed the former with flesh, and the latter with vegetables. Man can accustom himself to an extraordinary abstinence, and find it but little painful, if he employ tonic or stimulating substances (various drugs, small quantities of opium, betel, tobacco, or leaves of coca) ; or if he supply his stomach, from time to time, with earthy insipid substances, that are not in themselves fit for nutrition. Like man in a savage state, some animals, when pressed by hunger in winter, swallow clay or friable steatites; such are the wolves in the northeast of Europe, the rein-deer, and, according to the testimony of M. Patrin, the kids in Siberia. The Russian hunters, on the banks of the Yenisei and the Amour, use a clayey matter, which they call rock-butter, as a bait. The animals scent this clay from afar, and are fond of the smell; as the clays of bucaro, known in Portugal and Spain by the

[^340]name of odoriferous earths (tierras olorosas), have an odour agreeable to women.* Brown relates, in his History of Jamaica, that the crocodiles of South America swallow small stones and pieces of very hard wood, when the lakes which they inhabit are dry, or when they are in want of food. M. Bonpland and I observed in a crocodile, eleven feet long, which we dissected at Batallez, on the banks of the Rio Magdalena, that the stomach of this reptile contained half-digested fish, and rounded fragments of granite three or four inches in diameter. It is difficult to admit that the crocodiles swallow these stony masses accidentally, for they do not catch fish with their lower jaw resting on the ground at the bottom of the river. The Indians have framed the absurd hypothesis that these indolent animals like to augment their weight, that they may have less trouble in diving. I rather think that they load their stomach with large pebbles, to excite an abundant secretion of the gastric juice. The experiments of Majendie render this explanation extremely probable. With respect to the habit of the granivorous birds, particularly the gallinacem and ostriches, of swallowing sand and sinall pebbles, it has been hitherto attributed to an instinctive desire of accelerating the trituration of the aliments in a muscular and thick stomach.

We have mentioned, that tribes of Negrnes on the Gambia mingle clay with their rice. Some families of Ottomacs were perhaps formerly accustomed to cause the maize and other farinaceous seeds to rot in their poya, in order to eat earth and amylaceous matter together: possibly it was a preparation of this kind, that Father Gumilla described indistinctly in the first volume of his work, when he affirms, "that the Guamos and the Ottomacs feed upon earth only because it is impregnated with the sustancia del maiz, (substance of maize) and the fat of the cayman." I have already observed that neither the present missionary of Uruana, nor Tray Juan Gonzales, who lived long in those countries, knew anything of this mixture of animal and vegetable substances

[^341]with the poya. Perhaps Father Gumilla has confounded the preparation of the earth, which the natives swaliow, with the custom they still retain (of which M. Bonpland acquired the certainty on the spot) of burying in the ground the beans of a species of mimosacea, ${ }^{*}$ to cause them to enter into decomposition, so as to reduce them into a white bread, savoury, but difficult of digestion. I repeat that the balls of poya, which we took from the winter stores of the Indians, contained no trace of animal fat, or of amylaceous matter. Gumilla being one of the most credulous travellers we know, it almost perplexes us to credit facts, which even he has thought fit to reject. In the second volume of his work, he however gainsays a great part of what he advanced in the first; he no longer doubts, that "half at least (a lo menos) of the bread of the Ottomacs and the Guamos is clay." He asserts, "that children and full grown persons not only eat this bread without suffering in their health, but also great pieces of pure clay (muchos terrones de pura greda.)" He adds, that those who feel a weight on the stomach physic themselves with the fat of the crocodile, which restores their appetite, and enables them to continue to eat pure earth. $\dagger$ It is certain, that the Guamos are very fond, if not of the fat, at least of the flesh of the crocodile, which appeared to us white, and without any smell of musk. In Sennaar, according to Burckhardt, it is equally esteemed, and sold in the markets.

The little village of Uruana is more difficult to govern than most of the other missions. The Ottomacs are a restless, turbulent people, with unbridled passions. They are not only fond to excess of the fermented liquors prepared from cassava and maize, and of palm-wine, but they throw themselves into a peculiar state of intoxication, we might say of madness, by the use of the powder of niopo. They gather the long pods of a mimosacea, which we have made known by the name of Acacia niopo, $\ddagger$ cut them into pieces, moisten

[^342]them, and cause them to ferment. When the softened seeds begin to grow black, they are kneaded like a paste, mixed with some flour of cassava and lime procured from the shell of a helix, and the whole mass is exposed to a very brisk fire, on a gridiron made of hard wood. The hardened paste takes the form of small cakes. When it is to be used, it is reduced to a fine powder, and placed on a dish five or six inches wide. The Ottomac holds this dish, which has a handle, in his right hand, while he inhales the niopo by the nose, through the forked bone of a bird, the two extremities of which are applied to the nostrils. This bone, without which the Ottomac believes that he could not take this kind of snuff, is seven inches long: it appeared to me to be the legbone of a large sort of plover. The niopo is so stimulating, that the smallest portions of it produce violent sneezing in those who are not accustomed to its nse. Father Gumilla says, "This diabolical powder of the Ottomacs, furnished by an arborescent tobacco-plant, intoxicates them through the nostrils (emboracha por las narices), deprives them of reason for some hours, and renders them furious in battle." However varied may be the family of the leguminous plants in the chemical and medical properties of their seeds, juices, and roots, we cannot believe, from what we know hitherto of the group of mimosaceæ, that it is principally the pod of the Acacia niopo, which imparts the stimulant power to the suuff of the Ottomacs. This power is owing, no doubt, to the freshly calcined lime. We have shown above, that the mountaineers of the Andes of Popayan, and the Guajiros, who wander between the lake of Maracaybo and the Rio la Hacha, are also fond of swallowing lime as a stimulant, to augment the secretion of the saliva and the gastric juice.

A custom analogous to the use of the niopo just described, was observed by La Condamine among the natives of the Upper Marañon. The Omaguas, whose name is rendered celebrated by the expeditions attempted in search of El Dorado, have like the Ottomacs, a dish, and the hollow bone of a bird, by which they convey to their nostrils their powder of curupa. The seed that yields this powder is no doubt also a mimosacea; for the Ottomacs, according to
Orinoco. The chiga is a species of Inga, and I know of no other imosacea that can supply the place of the cerealia.

Father Gili, designate even now, at the distance of one humdred and sixty leagues from the Amazon, the Acacia niopo by the name of curupa. Since the geographical researches which I have recently made on the scene of the exploits of Philip von Huten, and the real situation of the province of Papamene, or of the Omaguas, the probability of an ancient communication between the Ottomacs of the Orinoco and the Omaguas of the Marainon has become more interesting and more probable. The former came from the Meta, perhaps from the country between the Meta and the Guaviare ; the latter assert, that they descended in great numbers to the Marañon by the Rio Jupura, coming from the eastern declivity of the Andes of New Grenada. Now, it is precisely between the Guayavero, (which joins the Guaviare, and the Caqueta, (which takes lower down the name of Japura,) that the country of the Omagua appears to be situate, of which the adventurers of Coro and Tocuyo in vain attempted the conquest. There is no doubt a striking contrast between the present barbarism of the Ottomacs and the ancient civilization of the Omaguas; but all parts of the latter nation were not perhaps alike advanced in civilization, and the example of tribes fallen into complete barbarism are unhappily but too common in the history of our species. Another point of resemblance may be remarked between the Ottomacs and the Omaguas. Both of these nations are celebrated among all the tribes of the Orinoco and the Amazon for their employment of caoutchouc in the manufacture of various articles of utility.
The real herbaceous tobacco* (for the missionaries have

[^343]the habit of calling the niopo or curupa tree-tobacco) has been cultivated from time immemorial by all the native people of the Orinoco; and at the period of the conquest the habit of smoking was found to be alike spread over both North and South America. The Tamanacs and the Maypures of Guiana wrap maize-leaves round their cigars, as the Mexicans did at the time of the arrival of Cortes. The Spaniards have substituted paper for the leaves of maize, in imitation of them. The poor Indians of the forests of the Orinoco know as well as did the great nobles at the court of Montezuma, that the smoke of tobacco is an excellent narcotic ; and they use it not only to procure their afternoon nap, but also to put themselves into that state of quiescence, which they call dreaming with the eyes open, or day-dreaming. The use of tobacco appears to me to be now very rare in the missions; and in New Spain, to the great regret of the revenue-officers, the natives, who are almost all descended from the lowest class of the Aztec people, do not smoke at all. Father Gili affirms, that the practice of chewing tobacco is unknown to the Indians of the Lower Orinoco. I rather doubt the truth of this assertion, having been told that the Sercucumas of the Erevato and the Caura, neighbours of the whitish Taparitos, swaliow tobacco chopped small, and impregnated with some other very stimulant juices, to prepare themselves for battle. Of the four species of nicotiana cultivated in Europe* we found only two growing wild; but the Nicotiana loxensis, and the Nicotiana andicola, which I found on the back of the Andes, at the height of eighteen hundred and fifty toises (almost the height of the Peak of Teneriffe), are very similar to the N . tabacum and N. rustica. The whole genus, however, is almost exclusively American, and the greater number of the species appeared to me to belong to the mountainous and temperate region of the tropics.

It was neither from Virginia, nor from South America, but from the Mexican province of Yucatan, that Europe received the first tobacco seeds, about the year 1559. $\dagger$ The

[^344]celebrated Raleigh contributed most to introduce the custom of smoking among the nations of the north. As early, as the end of the sixteenth century, bitter complaints were made in England " of this imitation of the manners of a savage people." It was feared that, by the practice of smoking tobacco, "Englishmen would degenerate into a barbarous state."

When the Ottomacs of Uruana, by the use of niopo (their arborescent tobacco), and of fermented liquors, hare thrown themselves into a state of intoxication, which lasts several days, they kill one another without ostensibly fighting. The most vindictive among them poison the nail of their thumb with curare; and, according to the testimony of the missionary, the mere impression of this poisoned nail mar become a mortal wound, if the curare be very active, and immediately mingle with the mass of the blood. When the Indians, after a quarrel at night, commit a murder, they throw the dead body into the river, fearing that some indications of the violence committed on the deceased may be observed. "Every time," said Father Bueno, "that I see the women fetch water from a part of the shore to which they are not accustomed to go, $I$ suspect that a murder has been committed in my mission."

We found in the Indian huts at Uruana the vegetable substance called "touchwood of ants," $\dagger$ with which we had become acquainted at the Great Cataracts, and which is employed to stop bleeding. This substance, which might
potato in Europe more than 120 or 140 years. When Raleigh brought tobacco from Virginia to England in 1586, whole fields of it were already cultivated in Portugal. It was also previously known in France, where it was brought into fashion by Catherine de Medicis, from whom it received the name of " herbe à la reine,"-" the queen's herb."

* This remarkuble passage of Camden is as follows, Annal. Elizabet. p. 143 (1585); "ex illo sane tempore [tabacum] usu cepit esse creberrimo in Anglia et magno pretio dum quamplurimi graveolentem illius fumum per tubulum testaceum hauriunt et mox e naribus efflant; adeo ut Anglorum corporum in barbarorum naturam degenerasse videantur, quum iidem ac barbari delectentur." We may see from this passage that they emitted the smoke through the nose; but at the court of Montezuma the pipe was held in one hand, while the nostrils were stopped with the other, in order that the smoke might be more easily swallowed. (Life of Raleigh, vol. i, p. $\mathbf{8}^{2}$ ).
$\uparrow$ Yesca de hormigas.
less improperly be called ants' nests, is in much request in a region whose inhabitants are of so turbulent a character. A new species of ant, of a fine emerald-green (Formica spinicollis), collects for its habitation a cotton-down, of a yellowish-brown colour, and very soft to the touch, from the leaves of a melastomacea. I have no doubt that the yesca or touchwood of ants of the Upper Orinoco (the animal is found, we were assured, only south of Atures) will one day become an article of trade. This substance is very superior to the ants' nests of Cayenne, which are employed in the hospitals of Europe, but can rarely be procured.

On the 7th of June we took leave with regret of Father Ramon Bueno. Of the ten missionaries whom we had found in different parts of the vast extent of Guiana, he alone appeared to me to be earnestly attentive to all that regarded the natives. He hoped to return in a short time to Madrid, where he intended to publish the result of his researches on the figures and characters that cover the rocks of Uruana.

In the countries we had just passed through, between the Meta, the Arauca, and the Apure, there were found, at the time of the first expeditions to the Orinoco, in 1535, those mute dogs, called by the natives maios, and auries. This fact is curious in many points of view. We cannot doubt that the dog, whatever Father Gili may assert, is indigenous in South America. The different Indian languages furnish words to designate this animal, which are scarcely derived from any European tongue. To this day the word auri, mentioned three hundred years ago by Alonzo de Herrera, is found in the Maypure. The dogs we saw at the Orinoco may perhaps have descended from those that the Spaniards carried to the coast of Caracas; but it is not less certain that there existed a race of dogs before the conquest, in Peru, in New Granada, and in Guiana, resembling our shepherds' dogs. The allco of the natives of Peru, and in general all the dogs that we found in the wildest countries of South America, bark frequently. The first historians, however, all speak of mute dogs (perros mudos). They still exist in Canada; and, what appears to me worthy of attention, it was this dumb variety that was eaten in preference in Mexico,* and at the Orinoco.

[^345]A very well informed traveller, M. Giesecke, who resided six years in Greenland, assured me that the dogs of the Esquimaux, which pass their lives in the open air, and bury themselves in winter beneath the snow, do not bark, but howl like wolves.*

The practice of eating the flesh of dogs is now entirely unknown on the banks of the Orinoco; but as it is a Tartar custom, spread through all the eastern part of Asia, it appears to me highly interesting for the history of nations to have ascertained that it existed heretofore in the hot regions of Guiana and on the table-lands of Mexico. I must observe, also, that on the confines of the province of Durango, at the northern extremity of New Spain, the Comanches have preserved the habit of loading the backs of the great dogs that accompany them in their migrations, with their tents of buffalo-leather. It is well known that employing dogs as beasts of burthen and of draught is equally common near the Slave Lake and in Siberia. I dwell on these features of conformity in the manners of nations, which become of some weight when they are not solitary, and are connected with the analogies furnished by the structure of languages, the division of time, and religious creeds and institutions.

We passed the night at the island of Cucuruparu, called also Playa de la Tortuga, because the Indians of Uruana go thither to collect the turtles' eggs. It is one of the best determined points of latitude along the banks of the Orinoco. I was there fortunate enough to observe the passage of three stars over the meridian. To the east of the island is the mouth of the Caño de la Tortuga, which descends from the mountains of Cerbatana, continually rrapped in electric clouds. On the southern bank of the Caño, between the tributary streams Parapara and Oche,

[^346]lies the almost ruined mission of San Miguel de la Tortuga. The Indians assured us that the environs of this little mission abound in otters with a very fine fur, called by the Portuguese 'water-dogs' (perritos de agua); and what is still more remarkable, in lizards (lagartos) with only two feet. The whole of this country, which is very accessible between the Rio Cuchivero and the strait of Baraguan, is worthy of being visited by a well-informed zoologist. The lagarto destitute of hinder extremities, is perhaps a species of Siren, different from the Siren lacertina of Carolina. If it were a saurian, a real Bimanis (Chirotes, Cuv.), the natives would not have compared it to a lizard. Besides the arrau turtles, of which I have in a former place given a detailed account, an innumerable quantity of land tortoises also, called morocoi, are found on the banks of the Orinoco, between Uruana and Encaramada. During the great heats of summer, in the time of drought, these animals remain without taking food, hidden beneath stones, or in the holes they have dug. They issue from their shelter and begin to eat, only when the humidity of the first rains penetrates into the earth. The terekay, or tajelu turtle which lives in fresh water, has the same habits. I have already spoken of the summer-sleep of some animals of the tropics. As the natives know the holes in which the tortoises sleep amidst the dried lands, they get out a great number at once, by digging fifteen or eighteen inches deep. Father Gili says that this operation, which he had seen, is not without danger, because serpents often bury themselves in summer with the terekays.

From the island of Cucuruparu, to the capital of Guiana, commonly called Angostura, we were but nine days on the water. The distance is somewhat less than ninetyfive leagues. We seldom slept on shore; but the torment of the mosquitos diminished in proportion as we advanced. We landed on the 8th of June at a farm (Hato de San Rafael del Capuchino) opposite the mouth of the Rio Apure. I obtained some good observations of latitude and longitude.* Having two months before taken horary angles

[^347]on the bank opposite Capuchino, these observations were important for deternining the rate of my chronometer, and connecting the situations on the Orinoco with those on the shore of Venezuela. The situation of this farm, being at the point where the Orinoco changes its course, (which had previously been from south to north,) and runs from west to east, is extremely picturesque. Granite rocks rise like islets amidst vast meadows. From their tops we discerned towards the north the Llanos of Calabozo bounding the horizon. We had been so long accustomed to the aspect of forests, that this view made a powerful impression on us. The steppes after sunset assume a tint of greenish gray. The visual ray being intercepted only by the rotundity of the earth, the stars seemed to rise as from the bosom of the ocean, and the most experienced mariner would have fancied himself placed on a projecting cape of a rocky coast. Our host was a Frenchman, who lived amidst his numerous herds. Though he had forgotten his native language, he seemed pleased to learn that we came from his country, which he had left forty years before; and he wished to retain us for some days at his farm. The small towns of Caycara and Cabruta were only a few miles distant from the farm; but during part of the year our host was in complete solitude. The Capuchino becomes an island by the inundations of the Apure and the Orinoco, and the communication with the neighbouring farms can be kept up only by means of a boat. The horned cattle then seek the higher grounds which extend on the south toward the chain of the mountains of Encaramada. This granitic chain is intersected by vallies, which contain magnetic sands (granulary oxidulated iron), owing no doubt to the decomposition of some amphibolic or chloritic strata.

On the morning of the 9 th of June we met a great number of boats laden with merchandize sailing up the Orinoco, in order to enter the Apure. This is a commercial road much frequented between Angostura and the port of Torunos in the province of of Varinas. Our fellow-traveller. Don Nicolas Soto, brother in law of the governor of Varinas, took the same course, to return to his family. At the the eastern bank of the Orinoco), the latitude $7^{\circ} 37^{\prime} 45^{\prime \prime}$, the longitude $69^{\circ} 5^{\prime} 30^{\prime \prime}$.
period of the high waters, several months are lost in contending with the currents of the Orinoco, the Apure, and the Rio de Santo Domingo. The boatmen are forced to carry out ropes to the trunks of trees, and thus warp their canoes up. In the great sinuosities of the river whole days are sometimes passed without advancing more than two or three hundred toises. Since my return to Europe, the communications between the mouth of the Orinoco and the provinces situated on the eastern slope of the mountains of Merida, Pamplona, and Santa Fé de Bogotá, have become more active; and it may be hoped that steamboats will facilitate these long voyages on the Lower Orinoco, the Portuguesa, the Rio Santo Domingo, the Orivante, the Meta, and the Guaviare. Magazines of cleft wood might be formed, as on the banks of the great rivers of the United States, sheltering them under sheds. This precaution would be indispensible, as, in the country through which we passed, it is not easy to procure dry fuel fit to keep up a fire beneath the boiler of a steam-engine.

We disembarked below San Rafael del Capuchino, on the right, at the Villa de Caycara, near a cove called Puerto Sedeño. The Villa is merely a few houses grouped together. Alta Gracia, la Ciudad de la Piedra, Real Corona, Borbon, in short all the towns or villas lying between the mouth of the Apure and Angostura, are equally miserable. The presidents of the missions, and the governors of the provinces, were formerly accnstomed to demand the privileges of villas and ciudades at Madrid, the moment the first foundations of a church were laid. This was a means of persuading the ministry, that the colonies were augmenting rapidly in population and prosperity. Sculptured figures of the sun and moon, such as I have already mentioned, are found near Caycara, at the Cerro del Tirano." It is "the work of the old people". (that is of our fathers), say the natives. On a rock

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more distant from the shore, and called Tecoma, the symbolic figures are found, it is said, at the height of a hundred feet. The Indians knew heretofore a road, that led by land from Caycara to Demerara and Essequibo.

On the northern bank of the Orinoco, opposite Caycara, is the mission of Cabruta, founded by the Jesuit Rotella, in 1740, as an advanced post against the Caribs. An Indian village, known by the name of Cabritu," had existed on the same spot for several ages. At the time when this little place became a Christian settlement, it was believed to be situate in $5^{\circ}$ latitude, or two degrees forty minutes more to the south than I found it by direct observations made at San Rafael, and at la Boca del Rio Apure. No idea was then conceived of the direction of a road that could lead by land to Nueva Valencia and Caracas, which were supposed to be at an immense distance. The merit of having first crossed the Llanos, to go to Cabruta, from the Villa de San Juan Baptista del Pao belongs to a woman. Father Gili relates, that Doña Maria Bargas was so devoted to the Jesuits, that she attempted herself to discover the way to the missions. She was seen with astonishment to arrive at Cabruta from the north. She took up her abode near the fathers of St. Ignatius, and died in their settlements on the banks of the Orinoco. Since that period, the northern part of the Llanos has been considerably peopled; and the road leading from the valleys of Aragua by Calabozo to San Fernando de Apure and Cabruta, is much frequented. The chief of the famous expedition of the boundaries made choice of the latter place in 1754, to establish dock-yards for building the vessels necessary for conveying his troops intended for the Upper Orinoco. The little mountain, that rises northeast of Cabruta, can be discerned from afar in the steppes, and serves as a landmark for travellers.

We embarked in the morning at Caycara; and driving with the current of the Orinoco, we soon passed the mouth of the Rio Cuchivero, which according to ancient tradition is the country of the Aikeambenanos, or women without husbands; and we there reached the paltry village of Alta Gracia, which is called a Spanish town. It was near this place, that

[^349]Jose de Iturriaga founded the Pueblo de Ciudad Real, which still figures on the most modern maps, though it has not existed for fifty years past, on account of the insalubrity of its situation. Beyond the point where the Orinoco turns to the east, forests are constantly seen on the right bank, and the llanos or steppes of Venezuela on the left. The forests which border the river, are not however so thick as those of the Upper Orinoco. The population, which augments perceptibly as you advance toward the capital, comprises but few Indians, and is composed chiefly of whites, negroes, and men of mixed descent. The number of the negroes is not great; but here, as everywhere else, the poverty of their masters does not tend to procure for them more humane treatment. An inhabitant of Caycara had just been condemned to four years' imprisonment, and a fine of one hundred piastres, for having, in a paroxysm of rage, tied a negress by the legs to the tail of his horse, and dragged her at full gallop through the savannah, till she expired. It is gratifying to record that the Audiencia was generally blamed in the country, for not having punished more severely so atrocious an action. Yet some few persons, who pretended to be the most enlightened and most sagacious of the community, deemed the punishment of a white contrary to sound policy, at the moment when the blacks of St. Domingo were in complete insurrection. Since I left those countries, civil dissensions have put arms into the hands of the slaves; and fatal exiperience has led the inhabitants of Venezuela to regret that they refused to listen to Don Domingo Tovar, and other right-thinking men, who, as early as the year 1795, lifted up their voices in the cabildo of Caracas, to prevent the introduction of blacks, and to propose means that might ammeliorate their condition.

After having slept on the 10th of June in an island in the middle of the river, (I believe that called Acaru by Father Caulin), we passed the mouth of the Rio Caura. This, the Aruy and the Oarony, are the largest tributary streams which the Orinoco receives on its right bank. All the Christian settlements are near the mouth of the river; and the villages of San Pedro, Aripao, Urbani, and Guaraguaraico, succeed each other at the distance of a few leagues. The first and the most populous, contains only about two

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hondred and fifty souls. San Luis de Guaraguaraico is a colony of negroes, some freed and others fugitives from Essequibo. This colony merits the particular attention of the Spanish Government, for it can never be sufficiently recommended to endeavour to attach the slaves to the soil, and suffer them to enjoy as farmers the fruits of their agricultural labours. The land on the Caura, for the most part a virgin soil, is extremely fertile. There are pasturages for more than 15,000 beasts; but the poor inhabitants have neither horses nor horned cattle. More than five-sixths of the banks of the Caura are either desert, or occupied by independent and savage tribes. The bed of the river is twice choked up by rocks: these obstructions occasion the famous Raudales of Mura and of Para or Paru, the latter of which has a portage, because it cannot be passed by canoes. At the time of the expedition of the boundaries, a small fort was erected on the northern cataract, that of Mura; and the governor, Don Manuel Centurion, gave the name of Ciudad de San Carlos to a few houses, which some families consisting of whites and mulattoes, had contructed near the fort. South of the cataract of Para, at the confluence of the Caura and the Erevato, the mission of San Luis was then situated; and a road by land led thence to Angostura, the capital of the province. All these attempts at civilization have been fruitless. No village now exists above the Raudal of Mura; and here, as in many other parts of the colonies, the natives may be said to have reconquered the country from the Spaniards. The valley of Caura may become one day or other highly interesting from the value of its productions, and the communications which it affords with the Rio Ventuari, the Carony, and the Cuyuni. I have shown above the importance of the four tributary streams which the Orinoco receives from the mountains of Parima. Near the mouth of the Caura, between the villages of San Pedro de Alcantara and San Francisco de Aripao, a small lake of four hundred toises in diameter was formed in 1790, by the sinking of the ground, consequent on an earthquake. It was a portion of the forest of Aripao, which sunk to the depth of eighty or a hundred feet below the level of the neighbouring land. The trees remained green for several
months; and some of them, it was believed, continued to push forth leaves beneath the water. This phenomenon is the more worthy of attention, as the soil of these countries - is probably granitic. I doubt the secondary formations of the Llanos being continued southward as far as the valley of Caura.

On the 11th of June we landed on the right bank of the Orinoco at Puerto de los Frailes, at the distance of three leagues above the Ciudád de la Piedra, to take altitudes of the sun. The longitude of this point is $67^{\circ} 26^{\prime} 20^{\prime \prime}$, or $1^{\circ} 41^{\prime}$ east of the mouth of the Apure. Farther on, between the towns of La Piedra and Muitaco, or Real Corona, are the Torno and Boca del Infierno, two points formerly dreaded by travellers. The Orinoco suddenly changes its direction; it flows first east, then north-north-west, and then again east. A little above the Caño Marapiche, which opens on the northern bank, a very long island divides the river into two branches. We passed on the south of this island without difficulty; northward, a chain of small rocks, half covered at high water, forms whirlpools and rapids. This is la Boca del Infierno, and the Raudal de Camiseta. The first expeditions of Diego Ordaz (1531) and Alonzo de Herrera (1535) have given celebrity to this bar. The Great Cataracts of the Atures and Maypures were then unknown; and the clumsy vessels (vergantines) in which travellers persisted in going up the river, rendered the passage through the rapids extremely difficult. At present no apprehension is felt in ascending or descending the Orinoco, at any season, from its mouth as far as the confluence of the Apure and the Meta. The only falls of water in this space are those of Torno or Camiseta, Marimara, and Cariven or Carichana Vieja. Neither of these three obstacles is to be feared with experienced Indian pilots. I dwell on these hydrographic details, because a great political and commercial interest is now connected with the communications between Angostura and the banks of the Meta and the Apure, two rivers that lead to the eastern side of the Cordilleras of New Grenada. The navigation from the mouth of the Lower Orinoco to the province of Varinas is difficult only on account of the current. The bed of the river nowhere presents obstacles more difficult to
be surmounted than those of the Danube between Vienna and Linz. We meet with no great bars, no real cataracts, until we get above the Meta. The Upper Orinoco, therefore, with the Cassiquiare and the Rio Negro, forms a particular system of rivers, where the active industry of Angostura and the shore of Caracas will remain long unknown.

I obtained horary angles of the sun in an island in the midst of the Boca del Infierno, where we had set up our instruments. The longitude of this point according to the chronometer is $67^{\circ} 10^{\prime} 31^{\prime \prime}$. I attempted to determine the magnetic dip and intensity, but was prevented by a heavy storm of rain. As the sky again became serene in the afternoon, we lay down to rest that night on a vast beach, on the southern bank of the Orinoco, nearly in the meridian of the little town of Muitaco, or Real Corona. I found the latitude by three stars to be $8^{\circ} 0^{\prime} 26^{\prime \prime}$, and the longitude $67^{\circ} 5^{\prime} 19^{\prime \prime}$. When the Observantin monks in 1752 made their first entradas on the territory of the Caribs, they constructed on this spot a small fort. The proximity of the lofty mountains of Araguacais renders Muitaco one of the most healthy places on the Lower Orinoco. There Iturriaga took up his abode in 1756, to repose after the fatigues of the expedition of the boundaries; and as he attributed his recovery to this hot rather than humid climate, the town, or more properly the village, of Real Corona took the name of Pueblo del Puerto sano. Going down the Orinoco more to the east, we left the mouth of the Rio Pao on the north, and that of the Arui on the south. The latter river, which is somewhat considerable, is often mentioned by Raleigh. The current of the Orinoco diminished in velocity as we advanced. I measured several times a base along the beach, to ascertain the time taken by floating bodies in traversing a known distance. Above Alta Gracia, near the mouth of the Rio Ujape, I had found the velocity of the Orinoco 2.3 feet in a second; between Muitaco and Borbon it was only 1.7 foot. The barometric observations made in the neighbouring steppes prove the small slope of the ground from the longitude of $69^{\circ}$ to the eastern coast of Guiana. We found in this country, on the right bank of the Orinoco, small formations of primitive grünstein, superimposed on granite (perhaps even embedded in the rock). We saw between

Muitaco and the island of Ceiba a hill entirely composed of balls with concentric layers, in which we perceived a close mixture of hornblende and feldspar, with some traces of pyrites. The grünstein resembles that in the vicinity of Caracas; but it was impossible to ascertain the position of a formation which appeared to me to be of the same age as the granite of Parima. Muitaco was the last spot where we slept in the open air on the shore of the Orinoco: we proceeded along the river two nights more before we reached Angostura, which terminated our voyage.

It would be difficult for me to express the satisfaction we felt on landing at Angostura, the capital of Spanish Guiana. The inconveniences endured at sea in small vessels are trivial in comparison with those that are suffered under a burning sky, surrounded by swarms of mosquitos, and lying stretched in a canoe, without the possibility of taking the least bodily exercise. In seventy-five days we had performed a passage of five hundred leagues (twenty to a degree) on the five great rivers, Apure, Orinoco, Atabapo, Rio Negro, and Cassiquiare; and in this vast extent we had found but a very small number of inhabited places. After the life we had led in the woods, our dress was not in the very best order, yet nevertheless M. Bonpland and I hastened to present ourselves to Don Felipe de Ynciarte, the governor of the province of Guiana. He received us in the most cordial manner, and lodged us in the house of the secretary of the Intendencia. Coming from an almost desert country, we were struck with the bustle of the town, though it contained only six thousand inhabitants. We admired the conveniences which industry and commerce furnish to civilized man. Humble dwellings appeared to us magnificent; and every person with whom we conversed, seemed to be epdowed with superior intelligence. Long privations give a value to the smallest enjoyments; and I cannot express the pleasure we felt, when we saw for the first time wheaten bread on the governor's table. Sensations of this sort are doubtless familiar to all who have made distant voyages.

A painful circumstance obliged us to sojourn a whole month in the town of Angostura. We felt ourselves on the first days after our arrival tired and enfeebled, but in perfect health. M. Bonpland began to examine the small number
of plants which he had been able to save from the influence of the damp climate; and I was occupied in settling by astronomical observations the longitude and latitude of the capital,* as well'as the dip of the magnetic needle. These labours were soon interrupted. We were both attacked almost on the same day by a disorder, which with my fellowtraveller took the character of a debilitating fever. At this period the air was in a state of the greatest salubrity at Angostura; and as the only mulatto servant we had brought from Cumana felt symptoms of the same disorder, it was suspected that we had imbibed the germs of typhus in the damp forests of Cassiquiare. It is common enough for travellers to feel no effects from miasmata till, on arriving in a purer atmosphere, they begin to enjoy repose. A certain excitement of the mental powers may suspend for some time the action of pathogenic causes. Our mulatto servant having been much more exposed to the rains than we were, his disorder increased with frightful rapidity. His prostration of strength was excessive, and on the ninth day his death was announced to us. He was however only in a state of swooning, which lasted several hours, and was followed by a salutary crisis. I was attacked at the same time with a violent fit of fever, during which I was made to take a mixture of honey and bark (the cortex Angostura) : a remedy much extolled in the country by the Capuchin missionaries. The intensity of the fever augmented, but it left me on the following day. M. Bonpland remained in a very alarming state, which during several weeks caused us the most serious inquietude. Fortunately he preserved sufficient self-possession to prescribe for himself; and he preferred gentler remedies, better adapted to his constitution. The fexer was continual; and, as almost always happens within the tropics, it was accompanied by dysentery. M. Bonpland displayed that courage and mildness of character, which never forsook him in the most trying situations. I was agitated by sad presages; for I remembered that the botanist Loefling, a pupil of Linnæus, died not far from Angostura, near the banks of the Carony, a victim of his

[^350]zeal for the progress of natural history. We had not yet passed a year in the torrid zone; and my too faithful memory conjured up everything I had read in Europe on the dangers of the atmosphere inhaled in the forests. Instead of going up the Orinoco, we might have sojourned some months in the temperate and salubrious climate of the Sierra Nevada de Merida. It was I who had chosen the path of the rivers; and the danger of my fellow-traveller presented itself to my mind as the fatal consequence of this imprudent choice.

After having attained in a few days an extraordinary degree of exacerbation, the fever assumed a less alarming character. The inflammation of the intestines yielded to the use of emollients obtained from malvaceous plants. The sidas and the melochias have singularly active properties in the torrid zone. The recovery of the patient however was extremely slow, as it always happens with Europeans who are not thoroughly seasoned to the climate. The period of the rains drew near ; and in order to return to the coast of Cumana, it was necessary again to cross the Llanos, where, amidst half-inundated lands, it is rare to find shelter, or any other food than meat dried in the sun. To avoid exposing M. Bonpland to a dangerous relapse, we resolved to stay at Angostura till the 10th of July. We spent part of this time at a neighbouring plantation, where mango-trees and bread-fruit trees* were cultivated. The latter had attained in the tenth year a height of more than forty feet. We measured several leaves of the Artocarpus, that were three feet long and eighteen inches broad, remarkable dimensions in a plant of the family of the dicotyledons.

[^351]PRINTED BY HARKISON AND SONS, London gazette office. st. martin's lant.

# PERSONAL NARRATIVE <br> OF <br> TRAVELS <br> TO THE <br> EQUINOCTIAL REGIONS <br> 0F AMERICA, <br> DURING THE YEARS 1799-1804. 

by alexander von humboldt and aimé bonpland.

WRITTEN IN FRENCH BY ALEXANDER VON HUMBOLDT:

TRANSLATED AND EDITED BY THOMASINA ROSS.

IN THREE VOLUMES.
VOL. III.

LONDON:
HENRY G. BOHN, YORK STREET, COVENT GARDEN
1853.

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# PERSONAL NARRATIVE 

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#### Abstract

Chapter XXV. Spanish Guiana.-Angostura.-Palm-inhabiting tribes.-Missions of the Capuchins.-The Laguna Parime.-El Dorado.-Legendary tales of the early voyagers.


I shall commence this chapter by a description of Spanish Guiana (Provincia de la Guyana), which is a part of the ancient Capitania general of Caracas. Since the end of the sisteenth century three towns have successively borne the name of St. Thomas of Guiana. The first was situated opposite to the island of Faxardo, at the confluence of the Carony and the Orinoco, and was destroyed* by the

* The first of the voyages undertaken at Raleigh's expense was in 1595 ; the second, that of Laurence Keymis, in 1596 ; the third, described by Thomas Masham, in 1597; and the fourth, in 1617. The first and last only were performed by Raleigh in person. This celebrated man was beheaded October the 29th, 1618. It is therefore the second town of Santo Tomas, now called Vieja Guyana, which existed in the time of Raleigh.
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Dutch, under the command of Captain Adrian Janson, in 1579. The second, founded by Antonio de Berrio in 1591, near twelve leagues east of the mouth of the Carony, made a courageous resistance to Sir Walter Raleigh, whom the Spanish writers of the conquest know only by the name of the pirate Reali. The third town, now the capital of the province, is fifty leagues west of the confluence of the Carony. It was begun in 1764, under the Governor Don Joacquin Moreno de Mendoza, and is distinguished in the public documents from the second town, vulgarly called the fortress (el castillo, las fortalezas), or Old Guayana (Vieja Guayana), by the name of Santo Thomé de la Nueva Guayana. This name being very long, that of Angostura* (the strait) has been commonly substituted for it.

Angostura, the longitude and latitude of which I have already indicated from astronomical nbservations, stands at the foot of a hill of amphibolic schist $\dagger$ bare of vegetation. The streets are regular, and for the most part parallel with the course of the river. Several of the houses are built on the bare rock; and here, as at Carichana, and in many other parts of the missions, the action of black and strong strata, when strongly heated by the rays of the sun upon the atmosphere, is considered injurious to health. I think the small pools of stagnant water (lagunas y anegadizos), which extend behind the town in the direction of south-east, are more to be feared. The houses of Angostura are lofty and convenient; they are for the most part built of stone; which proves that the inhabitants have but little dread of earthquakes. But unhappily this security is not founded on induction from any precise data. It is true, that the shore of Nueva Andalusia sometimes undergoes very violent shocks, without the commotion being propagated across the Llanos. The fatal catastrophe of Cumana, on the 4th of February, 1797, was not felt at Angostura; but in the great earthquake of 1766, which destroyed the same city, the

[^352]granitic soil of the two banks of the Orinoco was agitated as far as the Raudales of Atures and Maypures. South of these Raudales shocks are sometimes felt, which are confined to the basin of the Upper Orinoco and the Rio Negro. They appear to depend on a volcanic focus distant from that of the Caribbee Islands. We were told by the missionaries at Javita and San Fernando de Atabapo, that in 1798 violent earthquakes took place between the Guaviare and the Rio Negro, which were not propagated on the north towards Maypures. We cannot be sufficiently attentive to whatever relates to the simultaneity of the oscillations, and to the independence of the movements in contiguous ground. Everything seems to prove that the propagation of the commotion is not superficial, but depends on very deep crevices, that terminate in different centres of action.

The scenery around the town of Angostura is little varied; but the view of the river, which forms a vast canal, stretching from south-west to north-east, is singularly majestic.

When the waters are high, the river inundates the quays; and it sometimes happens that, even in the town, imprudent persons become the prey of crocodiles. I shall transcribe from my journal a fact that took place during M. Bonpland's illness. A Guaykeri Indian, from the island of La Margareta, was anchoring his canoe in a cove where there were not three feet of water. A very fierce crocodile, which habitually haunted that spot, seized him by the leg, and withdrew from the shore, remaining on the surface of the water. The cries of the Indian drew together a crowd of spectators. This unfortuaate man was first seen seeking, with astonishing presence of mind, for a knife which he had in his pocket. Not being able to find it, he seized the head of the crocodilo and thrust his fingers into its eyes. No man in the hot regions of America is ignorant that this carnivorous reptile, covered with a buckler of hard and dry scales, is extremely sensitive in the only parts of his body which are soft and unprotected, such as the eyes, the hollow underneath the shoulders, the nostrils, and beneath the lower jaw, where there are two glands of musk. The Guaykeri Indian was less fortunate than the negro of Mungo Park, and the girl of Uritucu, whom I mentioned in a former part of this work, for the crocodile did not open its jaws and lose hold
of its prey. The animal, overcome by pain, plunged to the bottom of the river, and, after having drowned the Indian, came up to the surface of the water, dragging the dead body to an island opposite the port. A great number of the inhabitants of Angostura witnessed this melancholy spectacle.

The crocodile, owing to the structure of its larynx, of the hyoiidal bone, and of the folds of its tongue, can seize, though not swallow, its prey under water; thus when a man disappears, the animal is usually perceived some hours after devouring its prey on a neighbouring beach. The number of individuals who perish annually, the victims of their own imprudence and of the ferocity of these reptiles, is much greater than is believed in Europe. It is particularly so in villages where the neighbouring grounds are often inundated. The same crocodiles remain long in the same places. They become from year to year more daring, especially, as the Indians assert, if they have once tasted of human flesh. These animals are so wary, that they are killed with difficulty. A ball does not pierce their skin; and the shot is only mortal when it penetrates the throat or a part beneath the shoulder. The Indians, who know little of the use of fire-arms, attack the crocodile with lances, after the animal has been caught with large pointed iron hooks, baited with pieces of meat, and fastened by a chain to the trunk of a tree. They do not approach the animal till it has struggled a long time to disengage itself from the iron fixed in the upper jaw. There is little probability that a country, in which a labyrinth of rivers without number brings every day new bands of crocodiles from the eastern back of the Andes, by the Meta and the Apure, toward the coast of Spanish Guiana, should ever be delivered from these reptiles. All that will be gained by civilization will be, to render them more timid and more easily put to flight.

Affecting instances are related of African slaves, who have exposed their lives to save those of their masters, who had fallen into the jaws of a crocodile. A few years ago, between Uritucu and the Mission de Abaxo, a negro, hearing the cries of his master, flew to the spot, armed with a long knife (machete), and plunged into the river. He forced the crocodile, by purting out his eyes, to let go his prey and to
plunge under the water. The slave bore his expiring master to the shore; but all succour was unavailing to restore him to life. He had died of suffocation, for his wounds were not deep. The crocodile, like the dog, appears not to close its jaws firmly while swimming.

The inhabitants of the banks of the Orinoco and its tributary streams discourse continually on the dangers to which they are exposed. They have marked the manners of the crocodile, as the torero has studied the manners of the bull. When they are assailed, they put in practice, with that presence of mind and that resignation which characterize the Indians, the Zamboes, and copper-coloured men in general, the counsels they have heard from their infancy. In countries where nature is so powerful and so terrible, man is constantly prepared for danger. We have mentioned before the answer of the young Indian girl, who delivered herself from the jaws of the crocodile-"I knew he would let me go if I thrust my fingers into his eyes." This girl belonged to the indigent class of the people, in whom the habits of physical want augment energy of character ; but how can we avoid being surprised, to observe in the countries convulsed by terrible earthquakes, on the table-land of the province of Quito, women belonging to the highest classes of society display in the moment of peril, the same calm, the same reflecting intrepidity? I shall mention one example only in support of this assertion. On the 4th of February, 1797, when 35,000 Indians perished in the space of a few minutes, a young mother saved herself and her children, crying out to them to extend their arms at the moment when the cracked ground was ready to swallow them up. When this courageous woman heard the astonishment that was expressed at a presence of mind so extraordinary, she answered, with great simplicity, "I had been told in my infancy: if the earthquake surprise you in a house, place yourself under a doorway that communicates from one apartment to another; if you be in the open air, and feel the ground opening beneath you, extend both your arms, and try to support yourself on the edge of the crevice." Thus, in savage regions, or in countries exposed to frequent convulsions, man is prepared to struggle with the beasts of the forest, to deliver himself from the jaws of
the crocodile, and to escape from the conflict of the elements.

The town of Angostura, in the early years of its foundation, had no direct communication with the mother-country. The inhabitants were contented with carrying on a trifling contraband trade in dried meat aid tobacco with the West India Islands, and with the Dutch colony of Essequibo, by the Rio Carony. Neither wine, oil, nor flour, three articles of iniportation the most sought after, was received directly from Spain. Some merchants, in 1771, sent the first schooner to Cadiz; and since that period a direct exchange of commodities with the ports of Andalusia and Catalonia has become extremely active. The population of Angostura,* after having been a long time languishing, has much increased since 1785. At the time of my abode in Guiana, however, it was far from being equal to that of Stabroek, the nearest English town. The mouths of the Orinoco have an advantage over every other part in Terra Firma. They afford the most prompt communications with the Peninsula. The voyage from Cadiz to Punta Barima is performed sometimes in eighteen or twenty days. The return to Europe takes from thirty to thirty-five days. These mouths being placed to windward of all the islands, the vessels of Angostura can maintain a more advantageous commerce with the West Indies than La Guayra and Porto Cabello. The merchants of Caracas, therefore, have been always jealous of the progress of industry in Spanish Guiana ; and Caracas having been hitherto the seat of the supreme government, the port of Angostura has been treated with still less favour than the ports of Cumana and Nueva Barcelona. With respect to the inland trade, the most active is that of the province of Varinas, which sends mules, cacao, indigo, cotton, and sugar to Angostura; and in return receives generos, that is, the

[^353]products of the manufacturing industry of Europe. I have seen long boats (lanchas) set off, the cargoes of which were valued at eight or ten thousand piastres. These boats went. first up the Orinoco to Cabruta; then along the Apure to San Vicente; and finally, on the Rio Santo Domingo, as far as Torunos, which is the port of Varinas Nuevas. The little town of San Fernando de Apure, of which I have already given a description, is the magazine of this river-trade, which might become more considerable by the introduction of steamboats.
I have now described the country throagh which we passed during a voyage of five hundred leagues; it remains for me to make known the small space of three degrees fificytwo minutes of longitude, that separates the present capital from the mouth of the Orinoco. Exact lnowledge of the delta, and the course of the Rio Carony, is at once interesting to hydrography and to European commerce.

When a vessel coming from sea would enter the principal mouth of the Orinoco, the Boca de Navios, it should make the land at the Punta Barima. The right or southern bank is the highest: the granitic rock pierces the marshy soil at a small distance in the interior, between the Caño Barima, the Aquire, and the Cuyuni. The left, or northern bank of the Orinoco, which stretches along the delta towards the Boca de Mariusas and the Punta Baxa, is very low, and is distinguishable at a distance only by the clumps of moriche palm-trees which embellish the passage. This is the sago-tree* of the country; it yields the flour of which

[^354]the yuruma bread is made; and far from being a palm-tree of the shore, like the Chamærops humilis, the common cocoa-tree, and the lodoicea of Commerson, is found as a palm-tree of the marshes as far as the sources of the Orinoco.* In the season of inundations these clumps of mauritia, with their leaves in the form of a fan, have the appearance of a forest rising from the bosom of the waters. The navigator, in proceeding along the channels of the delta of the Orinoco at night, sees with surprise the summit of the palm-trees illumined by large fires. These are the habitations of the Guaraons (Tivitivas and Waraweties of Raleigh $\dagger$ ), which are suspended from the trunks of trees. These tribes hang up mats in the air, which they fill with earth, and kindle, on a layer of moist clay, the fire necessary for their household wants. They have owed their liberty and their political independence for ages to the quaking and swampy soil, which they pass over in the time of drought, and on which they alone know how to walk in security to their solitude in the delta of the Orinoco; to their abode on the trees, where religious enthusiasm will probably never lead any American stylites. $\ddagger$ I have already mentioned in

Indian Archipelago, vol. i, p. 387 and 393.) This produce is triple that of corn, and double that of potatoes in France. But the plantain produces, on the same surface of land, still more alimentary substance than the sago-tree.

* I dwell much these divisions of the great and fine families of palms according to the distribution of the species: 1st, in dry places, or inland plains, Corgpha tectorum; 2nd, on the sea-coast, Chamærops humilis, Cocos nucifera, Corypha maritima, Lodoicea seychellarum, Labill.; 3rd, in the fresh-water marshes, Sagus Rumphii, Mauritia flexuosa; and 4th, in the alpine regions, between seven and fifteen hundred toises high, Ceroxylon andicola, Oreodosa frigida, Kunthia montana. This last group of palme montance, which rises in the Andes of Guanacas nearly to the limit of perpetual snow, was, I believe, entirely unknown before our travels in America. (Nov. Gen. vol. i, 1. 317; Semanario de Santa Fé de Bogotà, 1819, No. 21, p. 163.)
$\dagger$ The Indian name of the tribe of Uaraus (Guaraunos of the Spaniards) may be recognized in the Warawety (Ouaraucty) of Raleigh, one of the branches of the Tivitivas. See Discovery of Guiara, 1576, j. 90, and the sketch of the habitations of the Guaraons, in Raleghi brevis Descrip. Guiance, 1594, tab. 4.
$\ddagger$ This sect was founded by Simeon Sisanites, a native of Syria. He passed thirty-seven years in mystic contemplation, on five pillars, the last of which was thirty-six cubits high. The sancti columnares attempted
another place that the mauritia palm-tree, the "tree of life" of the missionaries, not only affords the Guaraons a safe dwelling during the risings of the Orinoco, but that its shelly fruit, its farinaceous pith, its juice, abounding in saccharine matter, and the fibres of its petioles, furnish them with food, wine,* and thread proper for making cords and weaving hammocks. These customs of the Indians of the delta of the Orinoco were found formerly in the Gulf of Darien (Uraba), and in the greater part of the inundated lands between the Guarapiche and the mouths of the Amazon. It is curious to observe in the lowest degree of human civilization the existence of a whole tribe depending on one single species of palm-tree, similar to those insects which feed on one and the same flower, or on one and the same part of a plant.

The navigation of the river, whether vessels arrive by the Boca de Navios, or risk entering the labyrinth of the bocas chicas, requires various precautions, according as the waters are high or low. The regularity of these periodical risings of the Orinoco has been long an object of admiration to travellers, as the overflowings of the Nile furnished the philosophers of antiquity with a problem difficult to solve. The Orinoco and the Nile, contrary to the direction of the Ganges, the Indus, the Rio de lajPlata, and the Euphrates, flow alike from the south toward the north; but the sources of the Orinoco are five or six degrees nearer to the equator than those of the Nile. Observing every day the accidental variations of the atmosphere, we find it difficult to persuade ourselves, that in a great space of time the effects of these variations mutually compensate each other: that in a long succession of years the averages of the temperature of the humidity, and of the barometric pressure, differ so little from month to month; and that nature, notwithstanding the multitude of partial perturbations, follows a constant type in the series of meteorological phenomena. Great rivers unite in one receptacle the waters which a surface

[^355]of several thousand square leagues receives. However unequal may be the quantity of rain that falls during several successive years, in such or such a valley, the swellings of rivers that have a very long course, are little affected by these local variations. The swellings represent the average of the humidity that reigns in the whole basin; they follow annually the same progression, because their commencement and their duration depend also on the mean of the periods, apparently extremely variable, of the beginning and end of the rains in the different latitudes, through which the principal trunk and its various tributary streams flow. Hence it follows, that the periodical oscillations of rivers are, like the equality of temperature of caverns and springs, a sensible indication of the regular distribution of humidity and heat, which takes place from year to year on a considerable extent of land. They strike the imagination of the vulgar; as order everywhere astonishes, when we cannot easily ascend to first causes. Rivers that belong entirely to the torrid zone display in their periodical movements that wonderful regularity which is peculiar to a region where the same wind brings almost always strata of air of the same temperature; and where the change of the sun in its declination causes every year at the same period a rupture of equilibrium in the electric intensity, in the cessation of the breezes, and the commencement of the season of rains. The Orinoco, the Rio Magdalena, and the Congo or Zaire, are the only great rivers of the equinoctial region of the globe, which, rising near the equator, have their mouths in a much higher latitude, though still within the tropics. The Nile and the Rio de la Plata direct their course, in the two opposite hemispheres, from the torrid zone towards the temperate.*

As long as, confounding the Rio Paragua of Esmeralda

[^356]with the Rio Guaviare, the sources of the Orinoco were sought towards the south-west, on the eastern back of the Andes, the risings of this river were attributed to a periodical melting of the snows. This reasoning was as far from the truth as that in which the Nile was formerly supposed to be swelled by the waters of the snows of Abyssinia. The Cordilleras of New Grenada, near which the western tributary streams of the Orinoco, the Guaviare, the Meta, and the Apure, take their rise, enter no more into the limit of perpetual snows, with the sole exception of the Paramos of Chita and Mucuehies, than the Alps of Abyssinia. Snowy mountains are much more rare in the torrid zone than is generally admitted; and the melting of the snows, which is not copious there at any season, does not at all increase at the time of the inandations of the Orinoco.
The cause of the periodical swellings of the Orinoco acts equally on all the rivers that take rise in the torrid zone. After the vernal equinos, the cessation of the breezes announces the season of rains. The increase of the rivers (which may be considered as natural pluviometers), is in proportion to the quantity of water that falls in the different regions. This quantity, in the centre of the forests of the Upper Orinoco and the Rio Negro, appeared to me to exceed 90 or 100 inches annually. Such of the natives, therefore, as have lived beneath the misty sky of the Esmeralda and the Atabapo, know, without the smallest notion of natural philosophy, what Eudoxus and Eratosthenes knew heretofore,* that the inundations of the great rivers are owing solely to the equatorial rains. The following is the usual progress of the oscillations of the Orinoco. Immediately after the vernal equinox (the people say on the 25th of March) the commencement of the rising is perceived. It is at first only an inch in twenty-four hours; sometimes the river again sinks in April; it attains its maximum in July; remains at the same level from the end of July till the 25th of August; and then decreases progressively, but more slowly than it increased. It is at its minimum in January and February. In both worlds the rivers of the northern torrid zone attain the greatest height nearly at the same period. The Ganges, the Niger, and the Gambia, reach the

[^357]maximum, like the Orinoco, in the month of August.* The Nile is two months later, either on account of some local circumstances in the climate of Abyssinia, or of the length of its course, from the country of Berber, or $17.5^{\circ}$ of latitude, to the bifurcation of the delta. The Arabian geographers assert, that in Sennaar and in Abyssinia the Nile begins to swell in the month of April (nearly as the Orinoco); the rise, however, does not become sensible at Cairo till toward the summer solstice; and the water attains its greatest height at the end of the month of September. $\dagger$ The river keeps at the same level till the middle of October; and is at its minimum in April and May, a period when the rivers of Guiana begin to swell anew. It may be seen from this rapid statement, that, notwithstanding the retardation caused by the form of the natural channels, and by local climatic circumstances, the great phenomenon of the oscillations of the rivers of the torrid zone is everywhere the same. In the two zodiacs vulgarly called the Tartar and Chaldean, or Egyptian (in the zodiac which contains the sign of the Rat, and in that which contains those of the Fishes and Aquarius), particular constellations are consecrated to the periodical overflowings of the rivers. Real cycles, divisions of time, have been gradually transformed into divisions of space; but the generality of the physical phenomena of the risings seems to prove that the zodiac which has been transmitted to us by the Greeks, and which, by the precession of the equinoxes, becomes an historical monument of high antiquity, may have taken birth far from Thebes, and from the sacred valley of the Nile. In the zodiacs of the New World-in the Mexican, for instance, of which we discover the vestiges in the signs of the days, and the periodical series which they compose-there are also signs of rain and of inundation corresponding to the Chou (Rat) of the Chinese $\ddagger$ and Thibetan cycle of Tse, and to the Fishes and Aquarius of the dodecatemorion. These two Mexican signs are Water (Atl) and Cipactli, the sea-monster furnished with

[^358]a horn. This animal is at once the Antelope-fish of the Hindoos, the Capricorn of our zodiac, the Deucalion of the Greeks, and the Noah (Coxcox) of the Azteks.* Thus we find the general results of comparative hydrography in the astrological monuments, the divisions of time, and the religious traditions of nations the most remote from each other in their situation and in their degree of intellectual advancement.
As the equatorial rains take place in the flat country when the sun passes through the zenith of the place, that is, when its declination becomes homonymous with the zone comprised between the equator and one of the tropics, the waters of the Amazon sink, while those of the Orinoco rise perceptibly. In a very judicious discussion on the origin of the Rio Congo, $\dagger$ the attention of philosophers has been already called to the modifications which the periods of the risings must undergo in the course of a river, the sources and the mouth of which are not on the same side of the equinoctial line. $\ddagger$ The hydraulic systems of the Orinoco and the Amazon furnish a combination of circumstances still more extraordinary. They are united by the Rio Negro and the Cassiquiare, a branch of the Orinoco; it is a navigable

[^359]line, between two great basins of rivers, that is crossed by the equator. The river Amazon, according to the information which I obtained on its banks, is much less regular in the periods of its oscillations than the Orinoco; it generally begins, however, to increase in December, and attains its maximum of height in March.* It sinks from the month of May, and is at its minimum of height in the months of July and August, at the time when the Lower Orinoco inundates all the surrounding land. As no river of America can cross the equator from south to north, on account of the general configuration of the ground, the risings of the Orinoco have an influenee on the Amazon; but those of the Amazon do not alter the progress of the oscillations of the Orinoco. It results from these data, that in the two basins of the Amazon and the Orinoco, the concave and convex summits of the curve of progressive increase and decrease correspond very regularly with each other, since they exhibit the difference of six months, which results from the situation of the rivers in opposite hemispheres. The commencement of the risings only is less tardy in the Orinoco. This river increases sensibly as soon as the sun has crossed the equator; in the Amazon, on the contrary, the risings do not commence till two months after the equinox. It is known that in the forests north of the line the rains are earlier than in the less woody plains of the southern torrid zone. To this local cause is joined another, which acts perhaps equally on the tardy swellings of the Nile. The Amazon receives a great part of its waters from the Cordillera of the Andes, where the seasons, as everywhere among mountains, follow a peculiar type, most frequently opposite to that of the low regions.

The law of the increase and decrease of the Orinoco is more difficult to determine with respect to space, or to the magnitude of the oscillations, than with regard to time, or the period of the maxima and minima. Having been able to measure but imperfectly the risings of the river, I report, not without hesitation, estimates that differ much from each other. $\dagger$ Foreign pilots admit ninety feet for the ordinary

[^360]rise in the Lower Orinoco. M. Depons, who has in general collected very accurate notions during his stay at Caracas, fixes it at thirteen fathoms. The heights naturally vary according to the breadth of the bed and the number of tributary streams which the principal trunk receives.

The people believe that every five years the Orinoco rises three feet higher than common; but the idea of this cycle does not rest on any precise measures. We know by the testimony of antiquity, that the oscillations of the Nile have been sensibly the same with respect to their height and duration for thousands of years; which is a proof, well worthy of attention, that the mean state of the humidity and the temperature does not vary in that vast basin. Will this constancy in physical phenomena, this equilibrium of the elements, be preserved in the New World also after some ages of cultivation? I think we may reply in the affirmative; for the united efforts of man cannot fail to have an influence on the general causes on which the climate of Guiana depends.

According to the barometric height of San Fernando de Apure, I find from that town to the Boca de Navios the slope of the Apure and the Lower Orinoco to be three inches and a quarter to a nautical mile of nine hundred and fifty toises.* We may be surprised at the strength of the current in a slope so little perceptible; but I shall remind the reader on this occasion, that, according to measurements made by order of Mr. Hastings, the Ganges was found, in a course of sixty miles (comprising the windings,) to have also only four inches fall to a mile; that the mean swiftness of this river is, in the seasons of drought, three miles an hour, and in those of rains six or eight miles. The strength of the current, therefure, in the Ganges as in the Orinoco, depends less on the slope of the bed, than on the accumulation of the higher waters, caused by the abundance of the rains, and the number of tributary streams. European colonists have already
the Orinoco, p. 38. Gumilla, vol. i, p. 56-59. Depons, vol. iii, p. 301. The greatest height of the rise of the Mississippi is, at Natchez, fifty-five English feet. This river (the largest perhaps of the whole temperate znne) is at its maximum from February to May; at its minimum in August and September.-Ellicott, Journal of an Expedition to the Ohio. + The Apure itself has a slope of thirteen inches to the mile.
been settled for two hundred and fifty years on the banks of the Orinoco; and during this long period of time, according to a tradition which has been propagated from generation to generation, the periodical oscillations of the river (the time of the beginning of the rising, and that when it attains its maximum) have never been retarded more than twelve or fifteen days.

When vessels that draw a good deal of water sail up toward Angostura in the months of January and February, by favour of the sea-breeze and the tide, they run the risk of taking the ground. The navigable channel often changes its breadth and direction; no buoy, however, has yet been laid down, to indicate any deposit of earth formed in the bed of the river, where the waters have lost their original velocity. There exists on the south of Cape Barima, as well by the river of this name as by the Rio Moroca and several estuaries (esteres) a communication with the English colony of Essequibo. Small vessels can penetrate into the interior as far as the Rio Poumaron, on which are the ancient settlements of Zealand and Middleburg. Heretofore this communication interested the government of Caracas only on account of the facility it furnished to an illicit trade; but since Berbice, Demerara, and Essequibo, have fallen into the hands of a more powerful neighbour, it fixes the attention of the Spanish Americans as being connected with the security of their frontiers. Rivers which have a course parallel to the coast, and are nowhere farther distant from it than five or six nautical miles, characterize the whole of the shore between the Orinoco and the Amazon.

Ten leagues distant from Cape Barima, the great bed of the Orinoco is divided for the first time into two branches of two thousand toises in breadth. They are known by the Indian names of Zacupana and Imataca. The first, which is the northernmost, communicates on the west of the islands Congrejos and del Burro with the bocas chicas of Lauran, Nuina, and Mariusas. As the Isla del Burro disappears in the time of great inundations, it is unhappily not suited to fortifications. The southern bank of the brazo Imataca is cut by a labyrinth of little channels, into which the Rio Imataca and the Rio Aquire flow. A long series of little granitic hills rises in the fertile savannahs between the Ima-
taca and the Cuyuni; it is a prolongation of the Cordilleras of Parima, which, bounding the horizon south of Angostura, forms the celebrated cataracts of the Rio Caroni, and approaches the Orinoco like a projecting cape near the little fort of Vieja Guyana. The populous missions of the Caribbee and Guiana Indians, governed by the Catalonian Capuchins, lie near the sources of the Imataca and the Aquire. The easternmost of these missions are those of Miamu, Camamu, and Palmar, situate in a hilly country, which extends towards Tupuquen, Santa Maria, and the Villa de Upata. Going up the Rio Aquire, and directing your course across the pastures towards the south, you reach the mission of Belem de Tumeremo, and thence the confluence of the Curumu with the Rio Cuyuni, where the Spanish post or destacamento de Cuyuni was formerly established. I enter into this topographical detail, because the Rio Cuyuni, or Cuduvini, runs parallel to the Orinoco from west to east, through an extent of $2 \cdot 5^{\circ}$ or $3^{\circ}$ of longitude,* and furnishes an excellent natural boundary between the territory of Caracas and that of English Guiana.

The two great branches of the Orinoco, the Zacupana and the Imataca, remain separate for fourteen leagues: on going up farther, the waters of the river are found united $\dagger$ in a single channel extremely broad. This channel is near eight leagues long; at its western extremity a second bifurcation appears; and as the summit of the delta is in the northern branch of the bifurcated river, this part of the Orinoco is highly important for the military defence of the country. All the channels $\ddagger$ that terminate in the bocas chicas, rise from the same point of the trunk of the Orinoco. The branch (Caño Manamo) that separates from it near the village of San Rafael has no ramification till after a course of three or four leagues; and by placing a small fort above the island

* Including the Rio Juruam, one of the principal branches of the Cuyuni. The Dutch military post is five leagues west of the union of Cuyuni with the Essequibo, where the former river receives the Mazuruni.
+ At this point of union are found two villages of Guaraons. They also bear the names of Imataca and Zacupana.
$\ddagger$ Caño de Manamo grande, C. de Manamo chico, C. Pedernales, C. Macareo, C. Cutupiti, C. Macuona, C. grande de Mariusas, \&c. The last three branches form by their union the sinuous channel cailed the Vuelta del Torno.
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of Chaguanes, Angostura might be defended against an enemy that should attempt to penetrate by one of the bocas chicas. In my time the station of the gun-boats was east of San Rafael, near the northern bank oif the Orinoco. This is the point which vessels must pass in sailing up toward Angostura by the northern channel, that of San Rafael, which is the broadest but the most shallow.
Six leagues above the point where the Orinoco sends off a branch to the bocas chicas is placed an ancient fort (los Castillos de la Vieja or Antigua Guayana,) the first construction of which goes back to the sixteenth century. In this spot the bed of the river is studded with rocky islands; and it is asserted that its breadth is nearly six hundred and fifty toises. The town is almost destroyed, but the fortifications subsist, and are well worthy the attention of the government of Terra Firma. There is a magnificent view from the battery established on a bluff north-west of the ancient town, which, at the period of great inundations, is entirely surrounded with water. Pools that communicate with the Orinoco form natural basins, adapted for the reception of vessels that want repairs.

After having passed the little forts of Vieja Guayana, the bed of the Orinoco again widens. The state of cultivation of the country on the two banks affords a striking contrast. On the north is seen the desert part of the province of Cu mana, steppes (Llanos) destitute of habitations, and extending beyond the sources of the Rio Mamo, toward the tableland or mesa of Guanipa. On the south we find three populous villages belonging to the missions of Carony, namely, San Miguel de Uriala, San Felix, and San Joaquin. The last of these villages, situate on the banks of the Carony, immediately below the great cataract, is considered as the embarcadero of the Catalonian missions. On navigating more to the east, between the mouth of the Carony and Angostura, the pilot should avoid the rocks of Guarampo, the sandbank of Mamo, and the Piedra del Rosario. From the numerous materials which I brought home, and from astronomical discussions, the principal results of which I have indicated above, I have, constructed a map of the country bounded by the delta of the Orinoco, the Carony, and the Cuyuni. This part of Guiana, from its proximity to the
coast, will some day offer the greatest attraction to European settlers.

The whole population of this vast province in its present state is, with the exception of a few Spanish parishes, scattered on the banks of the Lower Orinoco, and subject to two monastic governments. Estimating the number of the inhabitants of Guiana, who do not live in savage independence, at thirty-five thousand, we find nearly twenty-four thousand settled in the missions, and thus withdrawn as it were from the direct influence of the secular arm. At the period of my voyage, the territory of the Observantin monks of St. Francis contained seven thousand three huncred inhabitants, and that of the Capuchinos Catalanes seventeen thousand; an astonishing disproportion, when we. reflect on the smallness of the latter territory compared tothe vast banks of the Upper Orinoco, the Atabapo, the Cassiquiare, and the Rio Negro. It results from these statements that nearly two-thirds of the population of a province of sixteen thousand eight hundred square leagues are found concentrated between the Rio Imataca and the town of Santo Thomé del Angostura, on a space of ground only fifty-five leagues in length, and thirty in breadth. Both of these monastic governments are equally inaccessible to Whites, and form status in statu. The first, that of the Observantins, I have described from my own observations; it remains for me to record here the notions I could procure respecting the second of these govermments, that of the Catalonian Capuchins. Fatal civil dissensions and epidemic fevers have of late years diminished the long-increasing prosperity of the missions of the Carony; but, notwithstanding these losses, the region which we are going to examine is still highly interesting with respect to politieal economy.

The missions of the Catalonian Capuchins, which in 1804 contained at least sixty thousand head of cattle grazing in. the savannahs, extend from the eastern banks of the Carony and the Paragua as far as the banks of the Imataca, the Carumu, and the Cuyuni; at the south-east they border on English Guiana, or the colony of Essequibo; and toward the south, in going up the desert banks of the Paragua and the Paraguamasi, and crossing the Cordillera of Pacaraimo, c 2
they touch the Portuguese settlements on the Rio Branco. The whole of this country is open, full of fine savannahs, and no way resembling that through which we passed on the Upper Orinoco. The forests become impenetrable only on advancing toward the south; on the north are meadows intersected with woody hills. The most picturesque scenes lie near the falls of the Carony, and in that chain of mountains, two hundred and fifty toises high, which separates the tributary streams of the Orinoco from those of the Cuyuni. There are situate the Villa de Upata,* the capital of the missions, Santa Maria, and Cupapui. Small table-lands afford a healthy and temperate climate. Cacao, rice, cotton, indigo, and sugar, grow in abundance, wherever a virgin soil, covered with a thick coat of grasses, is subjected to cultivation. The first Christian settlements in those countries are not, I believe, of an earlier date than 1721. The elements of which the present population is composed are the three Indian races of the Guayanos, the Caribs, and the Guaycas. The last are a people of mountaineers, and are far from being so diminutive in size as the Guaycas whom we found at Esmeralda. It is difficult to fix them to the soil; and the three most modern missions in which they have been colleted, those of Cura, Curucuy, and Arechica, are already destroyed. The Guayanos, who early in the sixteenth century gave their name to the whole of that vast province, are less intelligent, but milder; and more easy, if not to civilize, at least to subjugate, than the Caribs. Their language appears to belong to the great branch of the Caribbee and Tamanac tongues. I.t displays the same analogies of roots and grammatical forms, which are observed between the Sanscrit, the Persian, the Greek, and the German. It is not easy to fix the forms of what is indefinite by its nature; and to agree on the differences which should be admitted between dialects, derivative languages, and mother-tongues. The Jesuits of Paraguay have made

[^361]known to us another tribe of Guayanos* in the southern hemisphere, living in the thick forests of Parana. Though it cannot be denied in general, that in consequence of distant migrations, $\dagger$ the nations that are settled north and south of the Amazon have had communications with each other, I will not decide whether the Guayanos of Parana and of Uruguay exhibit any other relation to those of Carony, than that of an homonomy, which is perhaps only accidental.
The most considerable Christian settlements `are now concentrated between the mountains of Santa Maria, the mission of San Miguel, and the eastern bank of the Carony, from San Buenaventura as far as Guri and the embarcadero of San Joaquin ; a space of ground which has not more than four hundred and sisty square leagues of surface. The savannahs to the east and south are almost uninhabited; we find there only the solitary missions of Belem, Tumuremo, Tupuquen, Puedpa, and Santa Clara. It were to be wished that the spots preferred for cultivation were distant from the rivers, where the land is higher, and the air more favourable to health. The Rio Carony, the waters of which, of an admirable clearness, are not well stocked with fish, is free from shoals from the Villa de Barceloneta, a little above the confluence of the Paragua, as far as the village of Guri. Farther north it winds between innumerable islands and rocks; and only the small boats of the Caribs venture to navigate amid these raudales, or rapids of the Carony. Happily the river is often divided into several branches; and consequently that can be chosen which, according to the height of the waters, presents the fewest whirlpools and shoals. The great fall, celebrated for the picturesque beauty of its situation, is a little above the village of Aguacaqua, or Carony, which in my time had a population of seven hundred Indians. This cascade is said to be from fifteen to twenty feet high; but the bar does not cross the whole bed of the river, which is more than three hundred feet broad. When the population is more extended toward the east, it will avail itself of the course of the small rivers Imataca and Aquire, the navigation of which is pretty free from danger.

* They are also called Guananas, or Gualachas.
$\dagger$ Like the celebrated migrations of the Omaguas, or Omeyuas.

The monks, who like to keep themselves isolated, in order to withdraw from the eye of the secular power, have been hitherto unwilling to settle on the banks of the Orinoco. It is, however, by this river only, or by the Cuyuni and the Essequibo, that the missions of Carony can export their productions. The latter way has not yet been tried, though several Christian settlements* are formed on one of the principal tributary streams of the Cuyuni, the Rio Juruario. This stream furnishes, at the period of the great swellings; the remarkable phenomenon of a bifurcation. It communicates by the Juraricuima and the Aurapa with the Rio Carony; so that the land comprised between the Orinoco, the sea, the Cuyuni, and the Carony, becomes a real islandFormidable rapids impede the navigation of the Upper Cuyuni; and hence of late an attempt has been made to open a road to the colony of Essequibo much more to the south-east, in order to fall in with the Cuyuni much below the mouth of the Curumu.

The whole of this southern territory is traversed by hordes of independent Caribs; the feeble remains of that warlike people who were so formidable to the missionaries till 1733 and 1735, at which period the respectable bishop Gervais de Labrid, $\dagger$ canon of the metropolitan chapter of Lyon, Father Lopez, and several other ecclesiastics, perished by the hands of the Caribs. These dangers, too frequent formerly, exist no longer, either in the missions of Carony, or in those of the Orinoco; but the independent Caribs continue, on account of their connection with the Dutch colonists of Essequibo, an object of mistrust and hatred to the government of Guiana. These tribes favour the contraband trade along the coast, and by the channels or estuaries that join the Rio Barima to the Rio Moroca; they carry off the cattle belonging to the missionaries, and excite the Indians recently converted, and living "within the sound of the bell," to return to the forests. The free hordes have everywhere a powerful interest in oppposing the progress

[^362]of cultivation and the encroachments of the Whites. The Caribs and the Aruacas procure fire-arms at Essequibo and Demerara; and when the traffic of American slaves (poitos) was most active, adventurers of Dutch origin took part in these incursions on the Paragua, the Erevato, and the Ventuario. Man-hunting took place on these banks, as heretofore (and probably still) on those of the Senegal and the Gambia. In both worlds Europeans have employed the same artifices, and committed the same atrocities, to maintain a trade that dishonours humanity. The missionaries of the Carony and the Orinoco attribute all the evils they suffer from the independent Caribs to the hatred of their neighbours, the Calvinist preachers of Essequibo. Their works are therefore filled with complaints of the secta diabolica de Calvino y de Lutero, and against the heretics of Dutch Guiana, who also think fit sometimes to go on missions, and spread the germs of social life among the savages.

Of all the vegetable productions of those countries, that which the industry of the Catalonian Capuchins has rendered the most celebrated is the tree that furnishes the Cortex angosture, which is erroneously designated by the name of cinchona of Carony. We were fortunate enough to make it first known as a new genus distinct from the einchona, and belonging to the family of meliacex, or of zanthoxylus. This salutary drug of South America was formerly attributed to the Brucea ferruginea which grows in Abyssinia, to the Magnolia glauca, and to the Magnolia plumieri. During the dangerous disease of M. Bonpland, M. Ravago sent a confidential person to the missions of Carony, to procure for us, by favour of the Capuchins of Upata, branches of the tree in flower, which we wished to be able to describe. We obtained very fine specimens, the leaves of which, eighteen inches long, diffused an agreeable aromatic smell. We soon perceived that the cuspare (the indigenous name of the cascarilla or corteza del Angostura) forms a new genus; and on sending the plants of the Orinoco to M. Willdenouw, I begged he would dedicate this plant to M. Bonpland. The tree, known at present by the name of Bonplandia trifoliata, grows at the distance of five or six leagues from the eastern bank of the Carony, at
the foot of the hills that surround the missions Capapui, Upata, and Alta Gracia. The Caribbee Indians make use of an infusion of the bark of the cuspare, which they consider as a strengthening remedy. M. Bonpland discovered the same tree west of Cumana, in the gulf of Santa Fé, where it may become one of the articles of exportation from Xew Andalusia.

The Catalonian monks prepare an extract of the Cortex angosturæ, which they send to the convents of their province, and which deserves to be better known in the north of Europe. It is to be hoped that the febrifuge and antidysenteric bark of the bonplandia will continue to be employed, notwithstanding the introduction of another, described by the name of false Angostura bark, and often confounded with the former. This false Angostura, or Angostura pseudo-ferruginea, comes, it is said, from the Brucea antidysenterica; it acts powerfully on the nerves, produces violent attacks of tetanus, and contain, according to the experiments of Pelletier and Caventon, a peculiar alkaline substance* analogous to morphine and strychnine. As the tree which yields the real Cortex angosture does not grow in great abundance, it is to be wished that plantations of it were formed. The Catalonian monks are well fitted to spread this kind of cultivation; they are more economical, industrious, and active than the other missionaries. They have already established tan-yards and cotton-spinning in a few villages; and if they suffer the Indians henceforth to enjoy the fruit of their labours, they will find great resources in the native population. Concentered on a small space of land, these monks have the consciousness of their political importance, and have from time to time resisted the civil authority, and that of their bishop. The governors who reside at Angostura have struggled against them with very unequal success, according as the ministry of Madrid showed a complaisant deference

* Brucine. M. Pelletier has wisely avoided using the word angosturine, because it might indicate a substance taken from the real Cortex angosturæ, or Bonplandia trifoliata. (Annales de Chimic, vol. xii, p. 117.) We saw at Peru the barks of two new species of weinmannia and wintera mixed with those of ciuchona; a mixture less dangerous, but till injurious, on account of the superabundance of tannin and acrid matter contained in the false cascarilla.
for the ecclesiastical hierarchy, or sought to limit its power. In 1768 Don Manuel Centurion carried off twenty thousand head of cattle from the missionaries, in order to distribute them among the indigent inhabitants. This liberality, exerted in a manner not very legal, produced very serious consequences. The gevernor was disgraced on the complaint of the Catalonian monks, though he had considerably extended the territory of the missions toward the south, and founded the Villa de Barceloneta, above the confluence of the Carony with the Rio Paragua, and the Ciudad de Guirior, near the union of the Rio Paragua and the Paraguamusi. From that period the civil administration has carefully avoided all intervention in the affairs of the Capuchins, whose opulence has been exaggerated like that of the Jesuits of Paraguay.

The missions of the Carony, by the configuration of their soil* and the mixture of savannahs and arable lands, unite the advantages of the Llanos of Calabozo and the valleys of Aragua. The real wealth of this country is founded on the care of the herds and the cultivation of colonial produce. It were to be wished that here, as in the fine and fertile province of Venezuela, the inhabitants, faithful to the labours of the fields, would not addict themselves too hastily to the research of mines. The example of Germany and Mexico proves, no doubt, that the working of metals is not at all incompatible with a flourishing state of agriculture; but, according to popular traditions, the banks of the Carony lead to the lake Dorado and the palace of "the gilded man :" $\dagger$ and this lake, and this palace, being a local fable, it might be dangerous to awaken remembrances which begin gradually to be effaced. I was assured that, in 1760, the independent Caribs went to Cerro de Pajarcima, a mountain to the south of Vieja Guayana, to submit the decomposed rock to the action of washing. The gold-dust collected by this labour was put into calabashes of the Crescentia cujete. and sold to the Dutch at Essequibo. Still more recently, some Mexican miners, who abused the credulity of Don

[^363]Jose Avalo, the intendant of Caracas, undertook a very considerable work in the centre of the missions of the Rio Carony, near the town of Upata, in the Cerros del Potrero and de Chirica. They declared that the whole rock was auriferous; stamping-mills, brocards, and smelting-furnaces were constructed. After having expended very large sums, it was discovered that the pyrites contained no trace whatever of gold. These essays, though fruitless, served to renew the ancient idea, "that every shining rock in Guiana is teeming with gold (una madre del oro)." Not contented with taking the mica-slate to the furnace, strata of amphibolic slates were shown to me near Angostura, without any mixture of heterogeneous substances, which had been worked under the whimsical name of black ore of gold (oro negro).

This is the place to make known, in order to complete the description of the Orinoco, the principal results of my researches on El Dorado, the White Sea, or Laguna Parime, and the sources of the Orinoco, as they are marked in the most recent maps. The idea of an auriferous earth, eminently rich, has been connected, ever since the end of the sixteenth century, with that of a great inland lake, which furnishes at the same time waters to the Orinoco, the Rio Branco, and the Rio Essequibo. I believe, from a more accurate knowledge of the country, a long and laborious study of the Spanish authors who treat of El Dorado, and, above all, from comparing a great number of ancient maps, arranged in chronological order, I have succeeded in discovering the source of these errors. All fables have some real foundation; that of El Dorado resembles those myths of antiquity, which, travelling from country to country, have beeu successively adapted to different localities. In the sciences, in order to distinguish truth from error, it often sulfices to retrace the history of opinions, and to follow their successive developments The discussion to which I shall devote the end of this chapter is important, not only because it throws light on the events of the Conquest, and that long series of disastrous expeditions made in search of El Dorado, the last of which was in the year 1775; it also furnishes, in addition to this simply historical interest, another, more substantial and more generally felt, that of rectifying the geography of South America, and of disembarrassing the
maps published in our days of those great laies, and that strange labyrinth of rivers, placed as if by chance between sixty and sixty-six degrees of longitude. No man in Europe believes any longer in the wealth of Guiana and the empire of the Grand Patiti. The town of Manoa, and its palaces covered with plates of massy gold, have long since disappeared; but the geographical apparatus serving to adorn the table of El Dorado, the lake Parima, which, similar to the lake of Mexico, reflected the image of so many sumptuous edifices, has been religiously preserved by geographers. In the space of three centuries, the same traditions have been differently modified; from ignorance of the American languages, rivers have been taken for lakes, and portages for branches of rivers; one lake, the Cassipa, has been made to advance five degrees of latitude toward the south, while another, the Parima or Dorado, has been transported the distance of a hundred leagues from the western to the eastern bank of the Rio Branco. From these various changes, the problem we are going to solve has become much more complicated than is generally supposed. The number of geographers who discuss the basis of a map, with regard to the three points of measures, of the comparison of descriptive works, and of the etymological study* of names, is extremely

[^364]small. Almost all the maps of South America which hare appeared since the year 1775 are, in what regards the interior of the country, comprised between the steppes of Venezuela and the river of the Amazons, between the eastern back of the Andes and the coast of Cayenne, a simple copy of the great Spanish map of La Cruz Olmedilla. A line, indicating the extent of country which Don Jose Solano boasted of having discovered and pacified by his troops and emissaries, was taken for the road followed by that officer, who never went beyond San Fernando de Atabapo, a village one hundred and sixty leagues distant from the pretended lake Parima. The study of the work of Father Caulin, who was the historiographer of the expedition of Solano, and who states very clearly, from the testimony of the Indians, "how the name of the river Parima gave rise to the fable of El Dorado, and of an inland sea," has been neglected. No use either has been made of a map of the Orinoco, three years posterior to that of La Cruz, and traced by Surville from the collection of true or hypothetical materials preserved in the archives of the Despacho universal de Indias. The progress of geography, as manifested on our maps, is much slower than might be supposed from the number of useful results which are found scattered in the works of different nations. Astronomical observations and topographic information accumulate during a long lapse of years, without being made use of; and from a principle of stability and preservation, in other respects praiseworthy, those who construct maps often choose rather to add nothing, than to sacrifice a lake, a chain of mountains, or an interbranching of rivers, which have figured there during ages.

The fabulous traditions of El Dorado and the lake Parima having been diversely modified according to the aspect of the countries to which they were to be adapted, we must distinguish what they contain that is real from what is merely imaginary. To avoid entering here into minute particulars, I shall begin first to call the attention of the reader to those spots which have been, at various periods, the theatre of the expeditions undertaken for the discovery of El Dorado. When we have learnt to know the aspect of the country, our maps of countries the least visited an appearance of exactness, the fulsity of which is discovered when we arrive on the spot.
and the local circumstances, such as they can now be described, it will be easy to conceive how the different hypotheses recorded on our maps have taken rise by degrees, and have modified each other. To oppose an error, it is suffcient to recall to mind the variable forms in which we have seen it appear at different periods.

Till the middle of the eighteenth century, all that rast space of land comprised between the mountains of French Guiana and the forests of the Upper Orinoco, between the sources of the Carony and the River Amazon (from $0^{\circ}$ to $4^{\circ}$ of north latitude, and from $57^{\circ}$ to $68^{\circ}$ of longitude), was so little known, that geographers could place in it lakes where they pleased, create communications between rivers, and figure chains of mountains more or less lofty. They have made full use of this liberty; and the situation of lakes, as well as the course and branches of rivers, has been varied in so many ways, that it would not be surprising, if among the great number of maps some were found that trace the real state of things. The field of hypotheses is now singularly narrowed. I have determined the longitude of Esmeralda in the UpperOrinoco; more to the east, amid the plains of Parima (a land as unknown as Wangara and Dar-Saley, in Africa), a band of twenty leagues broad has been travelled over from north to south along the banks of the Rio Carony and the Rio Branco, in the longitude of sixty-three degrees. This is the perilous road which was taken by Don Antonio Santos in going from Santo Thomé del Angostura to Rio Negro and the Amazon; by this road also the colonists of Surinam communicated very recently with the inhabitants of Grand Para. This road divides the terra incognita of Parima into two unequal portions; and fixes limits at the same time to the sources of the Orinoco, which it is no longer possible to carry back indefinitely toward the east, without supposing that the bed of the Rio Branco, which flows from north to south, is crossed by the bed of the Upper Orinoco, which flows from east to west. If we follow the course of the Rio Branco, or that strip of cultivated land which is dependent on the Capitania General of Grand Para, we see lakes, partly imaginary, and partly enlarged by geographers, forming two distinct groups. The first of these groups includes the lakes which they place between the Esmeralda and the Rio Branco; and to the
second belong those that are supposed to lie between the Rio Branco and the mountains of Dutch and French Guiana. It results from this sketch, that the question whether there exists a lake Parima on the east of the Rio Branco, is altogether foreign to the problem of the sources of the Orinoco.

Beside the country which we have just noticed (the Dorado de la Parime, traversed by the Rio Branco), another part of America is found, two hundred and sixty leagues toward the west, near the eastern back of the Cordillera of the Andes, equally celebrated in the expeditions to El Dorado. This is the Mesopotamia between the Caqueta, the Rio Negro, the Uaupes, and the Yurubesh, of which I have already given a particular account; it is the Dorado of the Omaguas, which contains Lake Manoa of Father Acunha, the Laguna de oro of the Guanes, and the aurifcrous land, whence Father Fritz received plates of beaten gold in his mission on the Amazon, toward the end of the seventeenth century.

The first, and above all the most celebrated enterprises attempted in search of El Dorado were directed toward the eastern back of the Andes of New Grenada. Fired with the ideas which an Indian of Tacunga had given of the wealth of the king or zaque of Cundirumarea, Sebastian de Belalcazar, in 1535, sent his captains Anasco and Ampudia, to discover the valley of El Dorado,* twelve days' journey from Guallabamba, consequently in the mountains between Pasto and Popayan. The intormation which Pedro de Anasco hed obtained from the natives, joined to that which was received subsequently (1536) by Diaz de Pineda, who had discovered the provinces of Quixos and Canela, between the Rio Napo and the Rio Pastaca, gare birth to the idea that on the east of the Nevados of Tunguragua, Cayambe, and Popayan, "were vast plains, abounding in precious metals, and where the inhabitants were covered

[^365]with armour of massy gold." Gonzales Pizarro, in searching for these treasures, discovered accidentally, in 1539, the cinnamon-trees of America, (Laurus cinnamomoïdes, Mut.); and Francisco de Orellana went down the Napo, to reach the river Amazon. Since that period expeditions were undertaken at the same time from Venezuela, New Grenada, Quito, Peru, and even from Brazil and the Rio de la Plata,* for the conquest of El Dorado. Those of which the remembrance have been best preserved, and which have most contributed to spread the fable of the riches of the Manaos, the Omaguas, and the Guaypes, as well as the existence of the lagunas de oro, and the town of 'the gilded king' (Grand Patiti, Grand Moxo, Grand Paru, or Enim), are the incursions made to the south of the Guaviare, the Rio Fragua, and the Caqueta. Orellana, having found idols of massy gold, had fixed men's ideas on an auriferous land between the Papamene and the Guaviare. His narrative, and those of the voyages of Jorge de Espira (George von Speier), Hernan Perez de Quesada, and Felipe de Urre (Philip von Huten), undertaken in 1536, 1542, and 1545, furnish, amid much exaggeration, proofs of very exact local knowledge. $\dagger$ When these are examined merely in a geographical point of view, we perceive the constant desire of the first conquistadores to reach the land comprised between the sources of the Rio Negro, of the Uaupes (Guape), and of the Jupura or Caqueta. This is the land which, in order to distinguish it from El Dorado de la Parime, we have called El Dorado des Omaguas. $\ddagger$ No doubt the whole country between the Amazon and the Orinoco was vaguely known by the name of las Provincias del Dorado; but in

[^366]this vast extent of forests, savannahs, and mountains, the progress of those who sought the great lake with auriferous banks, and the town of 'the gilded king,' was directed towards two points only, on the north-east and south-west of the Rio Negro; that is, to Parima (or the isthmus between the Carony, the Essequibo, and the Rio Branco), and to the ancient abode of the Manaos, the inhabitants of the banks of the Yurubesh. I have just mentioned the situation of the latter spot, which is celebrated in the history of the conquest from 1535 to 1560; and it remains for me to speak of the configuration of the country between the Spanish missions of the Rio Carony, and the Portuguese missions of the Rio Branco or Parima. This is the country lying near the Lower Orinoco, the Esmeralda, and French and Dutch Guiana, on which, since the end of the sixteenth century, the enterprises and exaggerated narratives of Raleigh have shed so bright a splendour.

From the general disposition of the course of the Orinoco, directed successively towards the west, the north, and the east, its mouth lies almost in the same meridian as its sources: so that by proceeding from Vieja Guyana to the south the traveller passes through the whole of the country in which geographers have successively placed an inland sea (Mar Blanco), and the different lakes which are connected with the El Dorado de la Parime. We find first the Rio Carony, which is formed by the union of two branches of almost equal magnitude, the Carony properly so called, and the Rio Paragua. The missionaries of Piritu call the latter river a lake (laguna): it is full of shoals, and little cascades; but, " passing through a country entirely flat, it is subject at the same time to great inundations, and its real bed (su verdadera casa) can scarcely be discovered." The natives have given it the name of Paragua or Parava, which means in the Caribbee language 'sea,' or 'great lake.' These local circumstances and this denomination no doubt have given rise to the idea of transforming the Rio Paragua, a tributary stream of the Carony, into a lake called Cassipa, on account of the Cassipagotos,* who lived in those coun-
*Raleigh, p. 64, 69. I always quote, when the contrary is not ex-
tries. Raleigh gives this basin forty miles in breadth; and; as all the lakes of Parima must have auriferous sands, he does not fail to assert, that in summer, when the waters retire, pieces of gold of considerable weight are found there.
The sources of the tributary streams of the Carony, the Arui, and the Caura (Caroli, Arvi, and Caora,* of the ancient geographers) being very near each other, this suggested the idea of making all these rivers take their rise from the pretended lake Cassipa.t. Sanson has so much enlarged this lake, that he gives it forty-two leagues in length, and fifteen in breadth. The ancient geographers placed opposite to each other, with very little hesitation, the tributary streams of the two banks of a river; and they place the mouth of the Carony, and lake Cassipa, which communicates by the Carony with the Orinoco, sometimes $\ddagger$ above the confluence of the Meta. Thus it is carried back by Hondius as far as the latitudes of $2^{\circ}$ and $3^{\circ}$, giving it the form of a rectangle, the longest sides of which run from north to south. This circumstance is worthy of remark, because, in assigning gradually a more southern latitude to the lake Cassipa, it has been detached from the Carony and
pressly said, the original edition of 1596. Have these tribes of Cassi. pagotos, Epuremei, and Orinoqueponi, so often mentioned by Raleigh, disappeared? or did some misapprehension give rise to these denominations? I am surprised to find the Indian words [of one of the different Carib dialects?] Ezrabeta cassipuna aquerewana, translated by Raleigh, "the great princes" or "greatest commander." Since acarwana certainly signifies a chief, or any person who commands (Raleigh, pp. 6 and 7), cassipuna perhaps means "great," and lake Cassipa is synonymous with great lake. In the same manner C'ass-iquiare may be a great river, for iquiare, like veni, is, on the north of the Amazon, a termination common to all rivers. Goto, however, in Cassipa-goto, is a Caribbee term denoting a tribe.

* D'Anville names the Rio Caura, Coari; and the Rio Arui, Aroay. I have not been able hitherto to guess what is meant by the Aloica (Atoca, Atoica of Raleigh), which issues from the lake Cassipa, between the Caura and the Arui.
† Raleigh makes only the Carony and the Arui issue from it (Hondius, Nieume Caerte van het wonderbare landt Guiana, besocht door Sir Walter Raleigh, 1594-1596): but in later maps, for instance that of Sanson, the Rio Caura issues also from Lake Cassipa.
$\ddagger$ Sanson. Map for the Voyaye of Acunha, 1680. Id. South America, 1659. Coronelli, Indes occidentales, 1689.

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the Arui, and has taken the name of Parima. To follow this metamorphosis in its progressive development, we must compare the maps which have appeared since the voyage of Raleigh till now. La Cruz, who has been copied by all the modern geographers, has preserved the oblong form of the lake Cassipa for his lake Parima, although this form is entirely different from that of the ancient lake Parima, or Rupunuwini, of which the great axis was directed from east to west. The ancient lake (that of Hondius, Sanson, and Coronelli) was also surrounded by mountains, and gave birth to no river; while the lake Parima of La Cruz and the modern geographers communicates with the Upper Orinoco, as the Cassipa with the Lower Orinoco.

I have stated the origin of the fable of the lake Cassipa, and the influence it has had on the opinion that the lake Parima is the source of the Orinoco. Let us now examine what relates to this latter basin, this pretended 'interior sea,' called Rupunuwini by the geographers of the sixteenth century. In the latitude of four degrees or four degrees and a-half, (in which direction unfortunately, south of Santo Thomé del Angostura to the extent of eight degrees, no astronomical observation has been made) is a long and narrow Cordillera, that of Pacaraimo, Quimiropaca, and Ucucuamo; which, stretching from east to south-west, unites the group of mountains of Parima to the mountains of Dutch and French Guiana. It divides its waters between the Carony, the Rupunury or Rupunwini, and the Rio Branco, and consequently between the valleys of the Lower Orinoco, the Essequibo, and the Rio Negro. On the north-west of the Cordillera de Pacaraimo, which has been traversed but by a small number of Europeans (by the German surgeon, Nicolas Hortsman, in 1739; by a Spanish officer, Don Antonio Santos, in 1775; by the Portuguese colonel, Barata, in 1791; and by several English settlers, in 1811), descend the Noeapra, the Paraguamusi, and the Paragua, which fall into the Rio Carony; on the north-east, the Rupunuwini, a tributary stream of the Rio Essequibo. 'Toward the south, the Tacutu and the Urariquera form together the famous Rio Parima, or Rio Branco.

This isthmus, between the branches of the Rio Essequibo and the Rio Branco (that is, between the Rupunuwini on
one side, and the Pirara, the Mahu, and the Uraricuera or Rio Parima on the other), may be considered as the classical soil of the Dorado of Parima. The rivers at the foot of the mountains of Pacaraimo are subject to frequent overflowings. Above Santa Rosa, the right bank of the Urariapara, a tributary stream of the Uraricuera, is called el Valle de la Inundacion. Great pools are also found between the Rio Parima and the Xurumu. These are marked on the maps recently constructed in Brazil, which furnish the most ample details of those countries. More to the west, the Caño Pirara, a tributary stream of the Mahu, issues from a lake covered with rushes. This is the lake Amucu described by Nicolas Hortsmann, and respecting which some Portuguese of Barcelos, who had visited the Rio Branco (Rio Parima or Rio Paravigiana), gave me precise notions during my stay at San Carlos del Rio Negro. The lake Amucu is several leagues broad, and contains two small islands, which Santos heard called Islas Ipomucera. The Rupunuwini (Rupunury), on the banks of which Hortsmann discovered rocks covered with hieroglyphical figures, approaches very near this lake, but does not communicate with it. The portage between the Rupunuwini and the Mahu is farther north, where the mountain of Ucucuamo" rises, which the natives still call 'the mountain of gold.' They advised Hortsmann to seek round the Rio Mahu for a mine of silver (no doubt mica with large plates), of diamonds, and of emeralds. He found nothing but rocky crystals. His account seems to prove that the whole length of the mountains of the Upper Orinoco (Sierra Parima) toward the east, is composed of granitic rocks, full of druses and open veins, like the Peak of Duida. Near these lands, which still enjoy a great celebrity for their riches, on the western limits of Dutch Guiana, live the Macusis, Aturajos, and Acuvajos. The traveller Santos found them stationed between the Rupunuwini, the Mahu, and the chain of Pacaraimo. It is the appearance of the micaceous rocks of the Ucucuamo, the name of the Rio Parima, the inundations of the rivers Urariapara, Parima, and Xurumu, and more especially the

* I follow the orthography of the manuscript journal of Rodriguez; it is the Cerro Acuquamo of Caulin, or rather of his commentator. (Hist. corogr., p. 176.)
existence of the lake Amucu (near the Rio Runpunuwin, and regarded as the principal source of the Rio Parima), which have given rise to the fable of the White Sea and the Dorado of Parima. All these circumstances (which have served on this very account to corroborate the general opinion) are found united on a space of ground which is eight or nine leagues broad from north to south, and forty long from east to west. This direction, too, was always assigned to the White Sea, by lengthening it in the direction of the latitude, till the beginning of the sixteenth century. Now this White Sea is nothing but the Rio Parima, which is called the White River (Rio Dranco, or Rio del Aguas blancas), and runs through and inundates the whole of this land. The name of Rupunuwini is given to the White Sea on the most ancient maps, which identifies the place of the fable, since of all the tributary streams of the Rio Essequibo the Rupunuwini is the nearest to the lake Amucu. Raleigh, in his first voyage (1595), had formed no precise idea of the situation of El Dorado and the lake Parima, which he believed to be salt, and which he calls "another Caspian Sea." It was not till the second voyage (1596), performed equally at the expense of Raleigh, that Laurence Keymis fixed so well the localities of El Dorado, that he appears to me to have no doubt of the identity of the Parima de Manao with the lake Amucu, and with the isthmus between the Rupunuwini (a tributary stream of the Essequibo) and the Rio Parima or Rio Branco. "The Indians," says Keymis, "go up the Dessekebe [Essequibo] in twenty days, towards the south. To mark the greatness of this river, they call it 'the brother of the Orinoco.' After twenty days' navigating they convey their canoes by a portage of one day, from the river Dessekebe to a lake, which the Jaos call Roponowini, and the Carbbees Parime. This lake is as large as a sca; it is covered with an infinite number of canoes; and I suppose" [the Indians then had told him nothing of this] "that this lake is no other than that which contains the town of Manua."* Hondius has given a curious plate of this portage; and, as the mouth of the Carony was then supposed to be

[^367]in latitude $4^{\circ}$ (instead of $8^{\circ} 8$ ), the portage of Parima was placed close to the equator. At the same period the Viapoco (Oyapoc) and the Rio Cayenne (Maroni?) were made to issue from this lake Parima. The same name being given by the Caribs to the western branch of the Rio Branco has perhaps contributed as much to the imaginary enlargement of the lake Amucu, as the inundations of the various tributary streams of the Uraricuera, from the confluence of the Tacutu to the Valle de la Inundacion.
We have shown above that the Spaniards took the Rio Paragua, or Parava, which falls into the Carony, for a lake, because the word parava signifies sea, lake, river. Parima seems also to denote vaguely "great water;" for the root par is tound in the Carib words that designate rivers, pools, lakes, and the ocean.* In Arabic and in Persian, bahr and deria are also applied at the same time to the sea, to lakes, and to rivers; and this practice, common to many nations in both worlds, has, on our ancient maps, converted lakes into rivers and rivers into lakes. In support of what I here advance, I shall appeal to very respectable testimony, that of Father Caulin. "When I inquired of the Indians," says this missionary, who sojourned longer than I on the banks of the Lower Orinoco, "what Parima was, they answered, that it was nothing more than a river that issued from a chain of mountains, the opposite side of which furnished waters to the Essequibo." Caulin, knowing nothing of lake Amucu, attributes the erroneous opinion of the existence of an inland sea solely to the inundations of the plains (á las inundaciones dilatadas por los bajos del pais). According to him, the mistakes of geographers arise from the vexatious circumstance of all the rivers of Guiana having different names at their mouths and near their sources. "I have no doubt," he adds, "that one of the upper branches of the Rio Branco is that very Rio Parima which the Spaniards have taken for a lake (a quien suponian laguna)." Such are the opinions which the historiographer of the Expedition of the Boundaries had formed on the spot. He could not expect that La Cruz and Surville, mingling old hypotheses with

[^368]accurate ideas, would reproduce on their maps the Mar Dorado or Mar Blanco. Thus, notwithstanding the numerous proofs which I have turnished since my return from America, of the non-existence of an inland sea the origin of the Orinoco, a map has been published in my name,* on which the Laguna Parima figures anew.

From the whole of these statements it follows, 1st, that the Laguna Rupunuwini, or Parima of the voyage of Raleigh and of the maps of Hondius, is an imaginary lake, formed by the lake Amucut and the tributary streams of the Uraricuera, which often overflow their banks; 2ndly, that the Laguna Parime of Surville's map is the lake Amucu, which gives rise to the Rio Pirara and (conjointly with the Mahu, the Tacutu, the Uraricuera, or Rio Parima, properly so called) to the lio Branco; 3rdly, that the Laguna Parime of La Cruz is an imaginary swelling of the Rio Parime (contounded with the Orinoco) below the junction of the Mahu with the Xurumu. The distance from the mouth of the Mahu to that of the Tacutu is scarcely $0^{\circ} 40^{\circ}$; La Cruz enlarges it to $7^{\circ}$ of latitude. He calls the upper part of the Rio Branco (that which receives the Mahu) Orinoco or Purumu. There can be no doubt of its being the Xurumu, one of the tributary streams of the Tacutu, which is well known to the inhabitants of the neighbouring fort of San Joaquim. All the names that figure in the fable of El Dorado are found in the tributary streams of the Rio Branco. Slight local circumstances, joined to the remembrances of the salt lake of Mexico, more especially of the celebrated lake Manoa in the Dorado des Omaguas, have served to complete a picture created by the imagination of Raleigh and his two lieutenants, Keymis and Masham. The inundations of the Rio Branco, I conceive, may be compared at the utmost to those of the Red River of Louisiana, between Nachitoches and Cados, but not to the Laguna de los Xarayes, which is a temporary swelling of the Rio Paraguay. $\ddagger$

* Carte de l'Amerique, dressee sur les Observations de M. de Humboldt, par Fried. (Vienna, 1818.)
+ This is the lake Amaca of Surville and La Cruz. By a singular mistake, the name of this lake is transformed to a village on Arrowsmith's map.
$\ddagger$ Southey, vol. i, p. 130. These periodical overflowings of the Rio

We have now examined a White Sea,* which the principal trunk of the Rio Branco is made to traverse; and another, $\dagger$ which is placed on the east of this river, and communicates with it by the Caño Pirara. A third lake $\ddagger$ is figured on the west of the Rio Branoo, respecting which I found recently some curious details in the manuscript journal of the surgeon Hortsmann. "At the distance of two days' journey below the confluence of the Mahu (Tacutu) with the Rio Parima (Uraricuera) a lake is found on the top of a mountain. This lake is stocked with the same fish as the Rio Parima; but the waters of the former are black, and those of the latter white." May not Surville, from a vague notion of this basin, have imagined, in his map prefixed to Father Caulin's work, an Alpine lake of ten leagues in length, near which, towards the east, rise at the same time the Orinoco, and the Rio Idapa, a tributary stream of the Rio Negro? However vague may be the account of the surgeon of Hildesheim, it is impossible to admit that the mountain, which has a lake at its summit, is to the north of the parallel of $2^{\circ} 30^{\prime}$ : and this latitude coincides nearly with that of the Cerro Unturan. Hence it follows, that the Alpine lake of Hortsmann, which has escaped the attention of D'Anville, and which is perhaps situate amid a group of mountains, lies north-east of the portage from the Idapa to the Mavaca, and south-east of the Orinoco, where it goes up above Esmeralda.
Most of the historians, who have treated of the first ages of the conquest, seem persuaded, that the name provincias or pais del Dorado denoted originally every region abounding in gold. Forgetting the precise etymology of the word El Dorado (the gilded), they have not perceived, that this tradition is a local fable, as were almost all the ancient fables of the Greeks, the Hindoos, and the Persians. The
Paraguay have long acted the same part in the southern hemisphere, as lake Parima has been made to perform in the northern. Hondius and Sanson have made the Rio de la Plata, the Rio Topajos (a tributary stream of the Amazon), the Rio Tocantines, and the Rio de San Francisco, issue from the Laguna de los Xaryes.

* That of D'Anville and La Cruz, and of the greater part of the modern maps.
$\dagger$ The lake of Surville, which takes the place of lake Amucu.
$\ddagger$ The lake which Surville calls "Laguna tenida hasta ahora or Ia una Parime"
history of 'the gilded man' belongs originally to the Andes of New Grenada, and particularly to the plains in the vicinity of their eastern side: we see it progressively advance, as I observed above, three hundred leagues toward the east-north-east, from the sources of the Caqueta to those of the Rio Branco and the Essequibo. Gold was sought in different parts of South America before 1536, without the word El Dorado having been ever pronounced, and without the belief of the existence of any other centre of civilization and wealth, than the empire of the Inca of Cuzco. Countries which now do not furnish commerce with the smallest quantities of the precious metals, the coast of Paria, Terra Firma (Castillo del Oro), the nountains of Santa Martha, and the isthmus of Darien, then enjoyed the same celebrity which has been more recently acquired by the auriferous lands of Sonora, Choco, and Brazil.

Diego de Ordaz (1531) and Alonzo de Herrera (1535) directed their journeys of discovery along the banks of the Lower Orinoco. The former is the famous Conquistador of Mexico, who boasted that he had taken sulphur out of the crater of the Peak of Popocatepetl, and whom the emperor Charles V. permitted to wear a burning volcano on his armorial bearings. Ordaz, named Adelantado of all the country which he could conquer between Brazil and the coast of Venezuela, which was then called the country of the German Company of Welsers (Belzares) of Augsburg, began his expedition by the mouth of the Marañon. He there saw, in the hands of the natives, "emeralds as big as a man's fist." They were, no doubt, pieces of that saussurite jade, or compact feldspar, which we brought home from the Orinoco, and which La Condamine found in abundance at the mouth of the Rio Topayos. The Indians related to Diego de Ordaz, "that on going up during a certain number of suns toward the west, he would find a large rock (peña) of green stone;" but before they reached this pretended mountain of emerald (rocks of euphotide?) a shipwreck put an end to all farther discovery. The Spaniards saved themselves with difficulty in two small vessels. They . hastened to get out of the mouth of the Amazon; and the currents, which in those parts run with violence to the
north-west, led Ordaz to the coast of Paria, where in the territory of the cacique Yuripari (Uriapari, Viapari), Sedeno had constructed the Casa fuerte de Paria. This post being very near the mouth of the Orinoco, the Mexican Conquistador resolved to attempt an expedition on this great river. He sojourned first at Carao (Caroa, Carora), a large Indian village, which appears to me to have been a little to the east of the confluence of the Carony; he then went up the Cabruta (Cabuta, Cabritu), and to the mouth of the Meta (Metacuyu), where he found great difficulty in passing his boats through the Raudal of Cariven. The Aruacas, whom Ordaz employed as guides advised him to go up the Meta; where, on advancing towards the west, they asserted he would find men clothed, and gold in abundance. Ordaz pursued in preference the navigation of the Orinoco, but the cataracts of Tabaje (perhaps even those of the Atures) compelled him to terminate his discoveries.

It is worthy of remark, that in this voyage, far anterior to that of Orellana, and consequently the greatest which the Spaniards had then performed on a river of the New World, the name of the Orinoco was for the first time heard. Ordaz, the leader of the expedition, affirms, that the river, from its mouth as far as the confluence of the Meta, is called Uriaparia, but that above this confluence it bears the name of Orinucu. This word (formed analogously with the words Tamanacu, Otomacu, Sinarucu) is, in fact, of the Tamanac tongue; and, as the Tamanacs dwell south-east of Encaramada, it is natural that the conquistadores heard the actual name of the river only on drawing near the Rio Meta.* On this last tributary stream Diego

* Gili, vol. iii, p. 381. The following are the most ancient names of the Orinoco, known to the natives near its mouth, and which historians give us altered by the double fault of pronunciation and orthography; Yuyapari, Yjupari, Huriaparia, Urapari, Viapari, Rio de Paria. The Tamanac word Orinucu was disfigured by the Dutch pilots into Worinoque. The Otomacs say, Joga-apurura, (great river); the Cabres and Guaypunabis, Parayua, Bazagua Parava, three words signifying great water, river, sea. That part of the Orinoco between the Apure and the Guaviare is often denoted by the name of Baraguan. A famous strait, which we have described above, bears also this name, which is no doubt a corruption of the word Paragua. Great rivers in every zone are called by the dwellers on their banks 'the river,' withont any particular
de Ordaz received from the natives the first idea of civilized nations, who inhabited the table-lands of the Andes of New Granada; " of a very powertul prince with one eye (Indio tuerto), and of animals less than stags, but fit for riding like Spanish horses." Ordaz had no idea that these animals were llamas (ovejas del Peru). Must we admit that llamas, which were used in the Andes to draw the plough and as beasts of burden, but not for riding, were already common on the north and east of Quito? I find that Orellana saw these animals at the river Amazon, above the confluence of the Rio Negro, consequently in a climate very different from that of the table-land of the Andes. The fable of an army of Omaguas mounted on llamas served to embellish the account given by the fellow-travellers of Felipe de Urre of their adventurous expedition to the Upper Caqueta We cannot be sufficiently attentive to these traditions, which seem to prove that the domestic animals of Quito and Peru had already begun to descend the Cordilleras, and spread themselves by degrees in the eastern regions of South America.

Herrera, the treasurer of the expedition of Ordaz, was sent in 1553, by the governor Geronimo de Ortal, to pursue the discovery of the Orinoco and the Meta. He lost nearly thirteen months between Punta Barina and the confluence of the Carony in constructing flat-bottomed boats, and making the preparations indispensable for a long voyage. We cannot read without astonishment the narrative of those daring enterprises, in which three or four hundred horses were embarked, to be put ashore whenever cavalry could act on one of the banks. We find in the expedition of Herrera the same stations which we already knew; the
denominations. If other names be added, they change in every province. Thus the Rio Turiva, near the Encarumada, has five names in the different parts of its course. The Upper Orinoco, or Paragua, is called by the Maquiritares (near Esmeralda) Maraguaca, on account of the lofty mountains of this name near Duida. Gili, vol. i, p. 22 and 364. Caulin, p. 75.) In most of the names of the rivers of America we recognize the root water. Thus yacu in the Peruvian, and veni in the Maypure tongues, signify water and river. In the Lule dialect 1 find fo, water; foyavalto, a river; foysi, a lake; as in Persian, ab is water; abi frat, the river Euphrates; ahdan, a lake. The rootwater is preserred in the derivatives.
fortress of Paria, the Indian village of Uriaparia (no doubt below Imataca, on a point where the inundations of the delta prevented the Spaniards from being able to procure firewood), Caroa, in the province of Carora; the rivers Caranaca (Caura?) and Caxavana (Cuchivero ?); the village of Cabritu (Cabruta), and the Raudal near the mouth of the Meta (probably the Raudal of Cariven and the Piedra de la Paciencia). As the Rio Meta, on account of the proximity of its sources and of its tributary streams to the auriferous Cordilleras of new Grenada (Cundinamarca), enjoyed great celebrity, Herrera attempted to go up this river. He thero found nations more civilized than those of the Orinoco, but that fed on the flesh of mute dogs. Herrera was killed in battle by an arrow poisoned with the juice of curare (yierva); and when dying named Alvaro de Ordaz his lieutenant, who led the remains of the expedition (1535) to the fortress of Paria, after having lost the few horses which had resisted a campaign of eighteen months.
Confused reports which were circulated of the wealth of the inhabitants of the Meta, and the other tributary streams that descend from the eastern side of the Cordilleras of New Grenada, engaged successively Geronimo de Ortal, Nicolas Federmann, and Jorge de Espira (George von Speier), in 15:35 and 1536, to undertake expeditions by land towards the south and south-west. From the promontory of Paria, as far as Cabo de la Vela, little figures of molten gold had been found in the hands of the natives, as early as the years 1498 and 1500 . The principal markets for these amulets, which the women used as ornanents, were the villages of Curiana (Coro) and Cauchieto (near the Rio la Hacha). The metal employed by th: founders of Cauchieto came from a mountainous country more to the south. It may be conceived, that the expeditions of Ordaz and Herrera served to increase the desire of drawing nearer to those auriferous countries. George von Speier left Coro (1535), and penetrated by the mountains of Merida to the banks of the Apure and the Meta. He passed these two rivers near their sources, where they have but little breadth. The Indians told him that, farther on, white men wandered about the plains. Speier, who imagined that he was not far from the banks of the Amazon,
had no doubt that these wandering Spaniards were men unfortunately shipwrecked in the expedition of Ordaz. He crossed the savannahs of San Juan de los Llanos, which were said to abound in gold; and made a long stay at an Indian village called Pueblo de Nuestra Señora, and afterwards La Fragua, south-east of the Paramo de la Suma Paz. I have been on the western back of this group of mountains, at Fusagasuga, and there heard that the plains by which they are skirted toward the east, still enjoy some celebrity for wealth among the natives. Speier found in the populous village of La Fragua a Casa del Sol (temple of the sun), and a convent of virgins similar to those of Peru and New Granada. Were these the consequence of a migration of religious rites towards the east? or must we admit that the plains of San Juan were their first cradle? Tradition, indeed, records that Bochica, the legislator of New Granada and high-priest of Iraca, had gone up from the plains of the east to the table-land of Bogotá. But Bochica being at once the offspring and the symbol of the sun, his history may contain allegories that are merely astrological. Speier, pursuing his way toward the south, and crossing the two branches of the Guaviare, which are the Ariare and the Guayavero (Guayare or Canicamare), arrived on the banks of the great Rio Papamene or Caqueta. The resistance he met with during a whole year in the province de los Choques, put an end, in 1537, to this memorable expedition. Nicolas Federmann and Geronimo de Ortal (1536), who went from Macarapana and the mouth of the Rio Neveri, followed (1535) the traces of Jorge de Espira. The former sought for gold in the Rio Grande de la Magdalena; the latter endeavoured to discover a temple of the sun (Casa del Sol) on the banks of the Meta. Ignorant of the idiom of the natives, they seemed to see everywhere, at the foot of the Cordilleras, the reflexion of the greatness of the temples of Iraca (Sogamozo), which was then the centre of the civilization of Cundinamarca.

I have now examined, in a geographical point of view, the expeditions on the Orinoco, and in a western and southern direction on the eastern back of the Andes, before the tradition of El Dorado was spread among the conquistadores. This tradition, as we have noticed above, had its origin in
the kingdom of Quito, where Luis Daza (1535) met with an Indian of Now Grenada, who had been sent by his prince (no doubt the zippa of Bogota, or the zaque of Tunja), to demand assistance from Atahualpa, inca of Peru. This ambassador boasted, as is usual, the wealth of his country; but what particularly fixed the attention of the Spaniards, who were assembled with Daza in the town of Tacunga (Llactacunga), was the history of a lord, "who, his body covered with powdered gold, went into a lake amid the mountains." This lake may have been the Laguna do Totta, a little to the east of Sogamozo (Iraca) and of Tunja (Hunca, the town of Huncahua), where two chiefs, ecclesiastical and secular, of the empire of Cundinamarca, on Cundirumarca, resided; but no historical remembrance being attached to this mountain lake, I rather suppose that it was the sacred lake of Guatavita, on the east of the mines of rock-salt of Zipaquira, into which the gilded lord was made to enter. I saw on its banks the remains of a staircase hewn in the rock, and serving for the ceremonies of ablution. The Indians said that powder of gold and golden vessels were thrown into this lake, as a sacrifice to the adoratorio de Guatavita. Vestiges are still found of a breach, which was made by the Spaniards for the purpose of draining the lake. The temple of the sun at Sogamozo being pretty near the northern coasts of Terra Firma, the notions of 'the gilded man' were soon applied to a high-priest of the sect of Bochica, or Indacanzas, who every morning, before he performed his sacrifice, caused powder of gold to be stuck upon his hands and face, after they had been smeared with grease. Other accounts, preserved in a letter of Oviedo addressed to the celebrated cardinal Bembo, say, that Gonzalo Pizarro, when he discovered the province of cinnamon-trees, "sought at the same time a great prince, noised in those countries, who was always covered with powdered gold, so that from head to foot he resembled an image of gold fashioned by the hand of a skilful workman (a una figura d'oro lavorato di mano d'un buonissimo orefice). The powdered gold is fixed on the body by means of an odoriferous resin; but, as this kind of garment would be uneasy to him while he slept, the prince washes himself every evening, and is gilded anew in the morning, which proves that the empire of El Dorado is
infinitely rich in mines." It seems probable that there was something in the ceremonies of the worship introduced by Bochica, which gave rise to a tradition so generally spread. The strangest customs are found in the New World. In Mexico the sacrificers painted their bodies, and wore a kind of cope, with hanging sleeves of tanned human skin.

On the banks of the Caura, and in other wild parts of Guiana, where painting the body is used instead of tattooing, the nations anoint themselves with turtle-fat, and stick spangles of mica with a metallic lustre, white as silver and red as copper, on their skin, so that at a distance they seem to wear laced clothes. The fable of 'the gilded man' is, perhaps, founded on a similar custom; and, as there were two sovereign princes in New Granada, the lama of Iraca, and the secular chief or zaque of Tunja, we cannot be surprised that the same ceremony was attributed sometimes to the prince, and sometimes to the high-priest. It is more extraordinary that, as early as the year 1535, the country of El Dorado was sought for on the east of the Andes. Robertson is mistaken in admitting that Orellana received the first notions of it (1540) on the banks of the Amazon. The history of Fray Piedro Simon, founded on the memoirs of Queseda, the conqueror of Cundirumarca, proves directly the contrary; and Gonzalo Diaz de Pineda, as early as 1536, sought for 'the gilded man' beyond the plains of the province of Quixos. The ambassador of Bogotá, whom Daza met with in the kingdom of Quito, had spoken of a country situate toward the east. Was this because the table-land of New Granada is not on the north, but on the north-east of Quito? We may venture to say, that the tradition of a naked man covered with powdered gold must have belonged originally to a hot region, and not to the cold table-lands of Cundirumarca, where I often saw the thermometer sink below four or five degrees; however, on account of the extraordinary configuration of the country, the climate differs greatly at Guatavita, Tunja, Iraca, and on the banks of the Sogamozo. Sometimes, also, religious ceremonies are preserved which took rise in another zone; and the Muyscas, according to ancient traditions, made Bochica, their first legislator and the founder of their worship, arrive from the plains situate to the east of the Cordilleras. I shall not
decide whether these traditions expressed an historical fact, or merely indicated, as we have already observed in another place, that the first Lama, who was the offispring and symbol of the sun, must necessarily have come from the countries of the East. Be it as it may, it is not less certain that the celebrity which the expeditions of Ordaz, Herrera, and Speier had already given to the Orinoco, the Meta, and the province of Papamene, situate between the sources of the Guaviare and Caqueta, contributed to fix the fable of El Dorado near to the eastern back of the Cordilleras.

The junction of three bodies of troops on the table-land of New Granada, spread through all that part of America occupied by the Spaniards the news of an immensely rich and populous country, which remained to be conquered. Sebastian de Belalcazar marched from Quito by way of Popayan (1536) to Bogotá; Nicholas Federmann, coming from-Venezuela, arrived from the east by the plains of Meta. These two captains found, already settled on the table-land of Cundirumarca, the famous Adelantado Gonzalo Ximenez de Queseda, one of whose descendants I saw near Zipaquira, with bare feet, attending cattle. The fortuitous meeting of the three conquistadores, one of the most extraordinary and dramatic events of the history of the conquest, took place in 1538. Belalcazar's narratives inflamed the imagination of warriors eager for adventurous enterprises ; and the notions communicated to Luis Daza by the Indian ot Tacunga were compared with the confused ideas which Ordaz had collected on the Meta respecting the treasures of a great king with one eye (Indio tuerto), and a peóple clothed, who rode upon llamas. An old soldier, Pedro de Limpias, who had accompanied Federmann to the table-land of Bogotá, carried the first news of El Dorado to Coro,

- where the remembrance of the expedition of Speier (15351537) to the Rio Papamene was still fresh. It was from this same town of Coro that Felipe von Huten (Urre, Utre) undertook his celebrated voyage to the province of the Omaguas, while Pizarro, Orellana, and Hernan Perez de Quesada, brother of the Adelantado, sought for the gold country at the Rio Napo, along the river of the Amazons, and on the eastern chain of the Andes of New Grenada. The natives, in order to get rid of their troublesome guests, con-
tinually described Dorado as easy to be reached, and situate at no considerable distance. It was like a phantom that seemed to flee before the Spaniards, and to call on them unceasingly. It is in the nature of man, wandering on the earth, to figure to himself happiness beyond the region which he knows. El Dorado, similar to Atlas and the islands of the Hesperides, disappeared by degrees from the domain of geography, and entered that of mythological fictions.

I shall not here relate the numerous enterprises which were undertaken for the conquest of this imaginary country. Unquestionably we are indebted to them in great part for our knowledge of the interior of America; they have been useful to geography, as errors and daring hypotheses are often to the search of truth: but in the discussion on which we are employed, it is incumbent on me to rest only upon those facts which have had the most direct influence on the construction of ancient and modern maps. Hernan Perez de Quesada, after the departure of his brother the Adelantado for Europe, sought anew (1539) but this time in the mountainous land north-east of Bogotá, the temple of the sun (Casa del Sol), of which Geronimo de Ortal had heard spoken in 1536 on the banks of the Meta. The worship of the sun introduced by Bochica, and the celebrity of the sanctuary of Iraca, or Sogamozo, gave rise to those confused reports of temples and idols of massy gold; but on the mountains as in the plains, the traveller believed himself to be always at a distance from them, because the reality never corresponded with the chimerical dreams of the imagination. Francisco de Orellana, after having vainly sought El Dorado with Pizarro in the Provincia de los Canelos, and on the auriferous banks of the Napo, went down (1540) the great river of the Amazon. He found there, between the mouths of the Javari and the Rio de la Trinidad (Yupura?) a province rich in gold, called Machiparo (Muchifaro), in the vicinity of that of the Aomaguas, or Omaguas. These notions contributed to carry El Dorado toward the southeast, for the names Omaguas (Om-aguas, Aguas), Dit-Aguas, and Papamene, designated the same country-that which Jorge de Espira had discovered in his expedition to the Caqueta. The Omaguas, the Manaos or Manoas, and the ruaypes (Uaupes or Guayupes) live in the plains on the
north of the Amazon. They are three powerful nations, the latter of which, stretching toward the west along the banks of the Guape or Uaupe, had been already mentioned in the voyages of Quesada and Huten. These two conquistadores, alike celebrated in the history of America, reached by different roads the llanos of San Juan, then called Valle de Nuestra Señora. Hernan Perez de Quesada (1541) passed the Cordilleras of Cundirumarca, probably betreen the Parnmos of Chingasa and Suma Paz; while Felipe de Huten, accompanied by Pedro de Limpias (the same who had carried to Venezuela the first news of Dorado from the table-land of Bogotá), directed his course from north to south, by the road which Speier had taken to the eastern side of the mountains. Huten left Coro, the principal seat of the German factory or company of Welser, when Henry Remboldt was its director. After having traversed (164i: the plains of Casanare, the Meta, and the Caguas, he arrived at the banks of the Upper Guaviare (Guayuare). a river which was long believed to' be the source 0 the Orinoco, and the mouth of which I saw in passing by San Fernando de Atabapo to the Rio Negro. Not far from the right bank of the Guaviare, Huten entered Macatoa, the city of the Guapes. The people there were clothed, the fields appeared well cultivated; everything denoted a degree of civilization unknown in the hot region of America which extends to the east of the Cordilleras. Speier, in his expedition to the Rio Caqueta and the province of Papamene, had probably crossed the Guaviare far above Macatoa, before the junction of the two branches of this river, the Ariari and the Guayavero. Huten was told, that on advancing more to the south-east he would enter the territory of the great nation of the Omaguas, the priest-king of which mas called Quareca, and which possessed numerous herds of llamas. These traces of cultivation-these ancient resemblances to the table-land of Quito-appear to me very remarkable. It has already been said above, that Orellana saw llamas at the dwelling of an Indian chief on the banks of the Amazon, and that Ordaz had heard mention made of them in the plains of Meta.
I pause where ends the domain of geography, and shall not follow Huter in the description either of that town of
roL. III.
immense extent, which he saw from afar; or of the battle of the Omaguas, where thirty-nine Spaniards (the names of fourteen are recorded in the annals of the time) fought against fifteen thousand Indians. These false reports contributed greatly to embellish the fable of El Dorado. The name of the town of the Omaguas is not found in the narrative of Huten; but the Manoas, from whom Father Fritz received, in the seventeenth century, plates of beaten gold, in his mission of Yurim-Aguas, are neighbours of the Omaguas. The name of Manoa subsequently passed from the country of the Amazons to an imaginary town, placed in $E l$ Dorado de la Parima. The celebrity attached to those countries between the Caqueta (Papamene) and the Guaupe (one of the tributary streams of the Rio Negro) excited Pedro de Ursua, in 1560, to that fatal expedition, which ended by the revolt of the tyrant Aguirre. Ursua, in going down the Caqueta to enter the river of the Amazons, heard of the province of Caricuri. This denomination clearly indicates 'the country of gold;' for I find that this metal is called caricuri in the Tamanac; and carucura in the Caribbee. Is it a foreign word, that denotes gold among the nations of the Orinoco, as the words sugar and cotton are in our European languages? This would prove that these nations learned to know the precious metals among the foreign products which came to them from the Cordilteras,* or from the plains at the eastern back of the Andes.

We arrive now at the period when the fable of El Dorado was fixed in the eastern part of Guiana, first at the pretended lake Cassipa (on the banks of the Paragua, a tributary stream of the Carony), and afterwards between the sources of the Rio Essequibo and the Rio Branco. This circumstance has had the greatest influence on the state of geography in those countries. Antonio de Berrio, son-inlaw $\dagger$ and sole heir of the great Adelantado Gonzalo Ximenez

[^369]de Quessada, passed the Cordilleras to the east of Tunja,* embarked on the Rio Casanare, and went down by this river, the Meta, and the Orinoco, to the island of Trinidad. We scarcely know this voyage except by the narrative of Raleigh ; it appears to have preceded a few years the first foundation of Tieja Guayana, which was in the year 1591. A few years later (1595) Berrio caused his maese de campo, Domingo de Vera, to prepare in Europe an expedition of two thousand men to go up the Orinoco, and conquer El Dorado, which then began to be called "the country of the Manoa,' and even the Laguna de la gran Manoa. Rich landholders sold their farms, to take part in a crusade, to which twelve Observantin monks, and ten secular ecclesiastice were annexed. The tales related by one Martinez $\dagger$

[^370](Juan Martin de Albujar?), who said he had been abandoned in the expedition of Diego de Ordaz, and led trom town to town till he reached the capital of El Dorado, had inflamed the imagination of Berrio. It is difficult to distinguish what this conquistador had himself observed in going down the Orinoco from what he said he had collected in a pretended journal of Martinez, deposited at Porto Rico. It appears, that in general at that period the same ideas prevailed respecting America as those which we have long entertained in regard to Africa; it was imagined that more civilization would be found towards the centre of the continent than on the coasts. Already Juan Gonzalez, whom Diego de Ordaz had sent in 1531 to explore the banks of the Orinoco, announced that "the farther you went up this river the more you saw the population increase." Berrio mentions the often-inundated province of Amapaja, between the confluence of the Meta and the Cuchivero, where he found many little idols of molten gold, similar to those which were fabricated at Cauchieto, east of Coro. He believed this gold to be a product of the granitic soil that covers the mountainous country between the Carichana, Uruana, and Cuchivero. In fact, the natives have recently found a mass of native gold in the Quebrada del Tigre, near the mission of Encaramada. Berrio mentions on the east of the province of Amapaja the Rio Carony (Caroly), which was said to issue from a great lake, because one of the tributary streams of the Carony, the Rio Paragua (river of the great water), had been taken for an inland sea, from ignorance of the Indian languages. Several of the Spanish historians believed that this lake, the source of the Carony, was the Grand Manoa of Berrio; but the notions he communicated to Raleigh show that the Laguna de Manoa (del Dorado, or de Parime,) was supposed to be to the south of the Rio Paragua, transformed into Laguna Cassipa. "Both these basins had auriferous sands; but on the banks of the Cassipa was situate Macureguarai (Margureguaira), the perhaps at Porto Rico, must have combined what he had heard from the Caribs with what he had learned from the Spaniards respecting the town of the Omaguas seen by Huten; of 'the gilded man' who sacrificed in a lake, and of the fight of the family of Atahualpa into the forests of Vilcabamba, and the eastern Cordillera of the Andes. (Garcilasso, vol. ii, p. 194).
capital of the cacique of Aromaja, and the first city of the imaginary empire of Guyana."

As these often-inundated lands have been at all times inhabited by nations of Carib race, who carried on a very active inland trade with the most distant regions, we must not be surprised that more gold was found here in the hands of the Indians than elsewhere. The natives of the coast did not employ this metal in the form of ornaments or amulets only; but also as a medium of exchange. It is not extraordinary, therefore; that gold has disappeared on the coast of Paria, and among the nations of the Orinoco, since their inland communications have been impeded by the Europeans. The natives who have remained independent are in our days, no doubt, more wretched, more indolent, and in a ruder state, than they were before the conquest. The king of Morequito, whose son Raleigh took to England, had visited Cumana in 1594, to exchange a great quantity of images of massy gold for iron tools, and European merchandise. The unexpected appearance of an Indian chief augmented the celcbrity of the riches of the Orinoco. It was supposed that El Dorado must be near the country from which the king of Morequito came; and as this country was often inundated, and rivers vaguely called great seas, or great basins of water, El Dorado must be on the banks of a lake. It was forgotten that the gold brought by the Caribs, and other trading people, was as little the produce of their soil as the diamonds of Brazil and India are the produce of the regions of Europe, where they are most abundant. The expedition of Berrio, which had increased in number during the stay of the vessels at Cumana, La Margareta, and the island of Trinidad, proceeded by Morequito (near Vieja Guayana) towards the Rio Paragua, a tributary stream of the Carony; but sickness, the ferocity of the natives, and the want of subsistence, opposed invincible obstacles to the progress of the Spaniards. They all perished; except about thirty, who returned in a deplorable state to the post of Santo Thomé.

These disasters did not calm the ardour displayed during the first half of the 17th century in the search of El Dorado. The governor of the island of Trinidad, Antonio de Berrio, became the prisoner of Sir Walter Raleigh, in the cele-
brated incursion of that navigator, in 1595, on the coast of Venezuela and at the mouths of the Orinoeo. Raleigh collected from Berrio, and from other prisoners made by Captain Preston* at the taking of Caracas, all the information which had been obtained at that period on the countries situate to the south of Vieya Guayana. He lent faith to the fables invented by Juan Martin de Albujar, and entertained no doubt either of the existence of the two latres Cassipa and Ropunuwini, or of that of the great empire of the Inca, which, after the death of Atahualpa, the fugitive princes were supposed to have founded near the sources of the Essequibo. We are not in possession of a map that was constructed by Raleigh, and which he recommended to lord Charles Howard to keep secret. The geographer Hondius has filled up this void; and has even added to his map a table of longitudes and latitudes, among which figure the laguna del Dorado, and the Ville Impériale de Mranoas. Raleigh, when at anchor near the Punta del Gallot in the island of Trinidad, made his lieutenants explore the mouths of the Orinoco, principally those of Capuri, Grand Amana (Manamo Grande), and Macureo (Macareo). As his ships

* These prisoners belonged to the expedition of Berrio and of Hernandez de Serpa. The English landed at Macuto (then Guayca Macuto), whence a white man, Villalpando, led them by a mountain-path between Cumbre and the Silla (perhaps passing over the ridge of Galipano) to the town of Caracas. (Simon, p. 594 ; Raleigh, p. 19.) Those only who are acquainted with the situation can be sensible how difficult and daring this enterprise was.
$\dagger$ The northern part of La Punta de Icacos, which is the sonth-east cape of the island of Trinidad. Christopher Columbus cast anchor there August 3, 1498. A great confusion exists in the denomination of the different capes of the island of Trinidad; and as recently, siace the expetion of Fidalgo and Churruca, the Spaniards reckon the longitudes in South America west of La Punta de la Galera (lat. $10^{\circ} 50^{\prime}$, long. $63^{\circ} 20^{\prime}$, it important to fix the attention of geographers on this point. Columbus called the south-east cape of the island Punta Galera, on account of the form of a rock. From Punta de la Galera he sailed to the west, and landed at a low cape, which he calls Punta del Arenal; this is our Punta de Icacos. In this passage, near a place (Punta de la Playa) where he stopped to take in water (perhaps at the mouth of the Rio Erin), he sawo to the south, for the first time, the continent of America, which he called Isla Santa. It was, therefore, the eastern coast of the province of Cu mana, to the eust of the Canno Macareo, near Punta Redonda, and not the mountainous coast of Paria (Isla de Gracia, of Columbus), which was first discovered.
drew a great deal of water, he found it difficult to enter the bocas ohicas, and was obliged to construct flat-bottomed barks. He remarked the fires of the Tivitivas (Tibitibies), of the race of the Guaraon Indians, on the tops of the mauritia palm-trees; and appears to have first brought the fruit to Europe (fructum squamosum, similem palme pini). I am surprised, that he scarcely mentions the settlement, which had been made by Berrio under the name of Santo Thomé (la Vieja Guayana.) This settlement however dates from 1591; and though, according to Fray Pedro Simon, "religion and policy prohibited all mercantile connection between Christians [Spaniards] and Heretics [the Dutch and English]," there was then carried on at the end of the sixteenth century, as in our days, an active contraband trade by the mouths of the Orinoco. Raleigh passed the river Europa (Guarapo), and "the plains of Saymas (Chaymas), which extend, keeping the same level, as far as Cumana and Caracas;" he stopped at Morequito (perhaps a little to the north of the site of the villa de Upata, in the missions of the Carony), where an old cacique confirmed to him all the reveries of Berrio on the irruption of foreign nations (Orejones and Epuremei) into Guiana. The Raudales or eataracts of the Caroli (Carony), a river which was at that period considered as the shortest way for reaching the towns of Macureguarai and Manoa, situate on the banks of lake Cassipa and of lake Rupunuwini or Dorado, put an end to this expedition.

Raleigh went scarcely the distance of sixty leagues along the Orinoco; but he names the upper tributary streams, according to thu vague notions he had collected; the Cari, the Pao, the Apure (Capuri?) the Guarico (Voari?) the Meta," and even, "in the province of Baraguan, the great

[^371]cataract of Athule (Atures), which prevents all further navigation." Notwithstanding Raleigh's exaggeration, so little worthy of a statesman, his narrative contains important materials for the history of geography. The Orinoco, abore the confluence of the Apure, was at that period as little known to Europeans, as in our time the course of the Niger below Sego. The names of several very remote tributary streams were known, but not their situation; and when the same name, differently pronounced, or not properly apprehended by the ear, furnished different sounds, their number was multiplied. Other errors had perhaps their source in the little interest which Antonio de Berrio, the Spanish governor, felt in communicating true and precise notions to Raleigh, who indeed complains of his prisoner, "as being utterly unlearned, and not knowing the east from the west." I shall not here discuss the point, how far the belief of Raleigh, in all he relates of inland seas, similar to the Caspian sea ; on "the imperial and golden city of Manoa," and on the magnificent palaces built by the emperor Inga of Guyana, in imitation of those of his ancestors at Peru, was real or pretended. The learned historian of Brazil, Mr. Southey, and the biographer of Raleigh, Sir G. Cayley, have recently thrown much light on this subject. It seems to me difficult to doubt of the extreme credulity of the chief of the expedition, and of his lieutenants. We see Raleigh adapted everything to the hypotheses he had previously formed. He was certainly deceived himself; but when he sought to influence the imagination of queen Elizabeth, and execute the projects of his own ambitious policy, he neglected none of the artifices of flattery. He described to the Queen "the transports of those barbarous nations at the sight of her picture;" he would have "the name of the august virgin, who knows how to conquer empires, reach as far as the country of the warlike women of the Orinoco and the Amazon;" he asserts, that, "at the period when the that of the nation of Betoyes, of the plains of the Casanare and the Meta? Hondius, and the geographers who have followed him, with the exception of De L'Isle (1700), and of Sanson ( 1656 ), place the province of Amapaja erroneously to the east of the Orinoco. We see clearly by the narrative of Raleigh (p. 26 and j2), that Amapaja is the inundated country between the Meta and the Guarico. Where are the rivers Dauney and Ubarro? The Guaviare appears to me to be the Goavar of Raleigh.

Spaniards overthrew the throne of Cuzco, an ancient prophecy was found, which predicted that the dynasty of the Incas would one day owe its restoration to Great Britain;" he advises, that, "on pretext of defending the territory against external enemies, garrisons of three or four thousand English should be placed in the towns of the Inca, obliging this prince to pay a contribution annually to Queen Elizabeth of three hundred thousand pounds sterling;" finally, he adds, like a man who foresees the future, that "all the vast countries of South America will one day belong to the English nation." ${ }^{*}$

The four voyages of Raleigh to the Lower Orinoco succeeded each other from 1595 to 1617. After all these useless attempts, the ardour of research after El Dorado has greatly diminished. No expeditions have since been formed by a numerous band of colonists; but some solitary enterprises have been encouraged by the governors of the provinces. The notions spread by the journeys of Father Acunha in 1688, and Father Fritz in 1637, to the auriferous land of the Manoas of Jurubesh, and to the Laguna de Oro, contributed to renew the ideas of El Dorado in the Portuguese and Spanish colonies north and south of the equator. At Cuenza, in the kingdom of Quito, I met with some men, who were employed by the bishop Marfil to seek at the east of the Cordilleras, in the plains of Macas, the ruins of the town of Logrono, which was believed to be situate in a country rich in gold. We learn by the journal of Hortsmann, which I have often quoted, that it was supposed, in 1740, El Dorado might be reached from Dutch Guiana by going up the Rio Essequibo. Don Manuel Centurion, the

* "I showed them her Majesty's picture, which the Casigui so admired and honoured, as it had been easy to have brought them idolatrous thereof. And I further remember that Berreo confessed to me and others (which I protest before the majesty of God to be true), that there was found among prophecies at Peru (at such a time as the empire was reduced to the Spanish obedience) in their chiefest temple, among divers others which foreshowed the losse of the said empyre, that from Inglatierra those Ingas should be again in time to come restored. The Inga would yield to her Majesty by composition many hundred thousand pounds yearely as to defend him against all enemies abroad and defray the expenses of a garrison of 3000 or 4000 soldiers. It seemeth to me that this Empyre of Guiana is reserved for the English nation." (Ilaleigh, p. 7, 17, 51, 100.)
governor of Santo Thomé del Angostura, displayed an extreme ardour for reaching the imaginary lake of Manoa. Arimuicaipi, an Indian of the nation of the Ipurucotos, went down the Rio Carony, and by his false narrations inflamed the imagination of the Spanish colonists. He showed them in the southern sky the Clouds of Magellan. the whitish light of which he said was the reflection of the argentiferous rocks situate in the middle of the Laguna Parima. This was describing in a very poetical manner the splendour of the micaceous and talky slates of his country! Another Indian chief, known among the Caribs of Essequibo by the name El Capitan Jurado, vainly attempted to undeceive the governor Centurion. Fruitless attempts were made by the Caura and the Rio Paragua; and several hundred persons perished miserably in these rash enterprises, from which, however, geography has derived some advantages. Nicolas Rodriguez and Antonio Santos (17751780) were employed by the Spanish governor. Santos, proceeding by the Carony, the Paragua, the Paraguamusi, the Anocapra, and the mountains of Pacaraymo and Quimiropaca, reached the Uraricuera and the Rio Branco. I found some valuable information in the journals of these perilous expeditions.

The maritime charts which the Florentine traveller, Amerigo Vespucci,* constructed in the early years of the sixteenth century, as Piloto mayor de la Casa de Contratacion of Seville, and in which he placed, perhaps artfully, the words Tierra de Amerigo, have not reached our times. The most ancient monument we possess of the geography of the New Continent, $\dagger$ is the map of the world by John Ruysch, annexed to a Roman edition of Ptolemy in 1508. We there find Yucatan and Honduras (the most southern part of Mexico) $\ddagger$ figured as an island, by the name of Culicar.

[^372]There is no isthmus of Panama, but a passage, which permits of a direct navigation from Europe to India. The great southern island (South America) bears the name of Terra de Pareas, bounded by two rivers, the Rio 'Lareno and the Rio Formoso. These Pareas are, no doubt, the inhabitants of Paria, a name which Christopher Columbus had already heard in 1498, and which was long applied to a great part of America. Bishop Geraldini says clearly, in a letter addressed to Pope Leo X, in 1516: "Insula illa, quee Europa et Asia est major, quam indocti Continentem Asia appellant, et alii Americam vel Pariam nuncupant [that island, larger than Europe and Asia joined together, which the unlearned call the continent of Asia, and others America or Paria].*" I find in the map of the world of 1508 no trace whatever of the Orinoco. This river appears, for the first time, by the name of Rio Dolce, on the celebrated map constructed in 1529 by Diego Ribeyro, cosmographer of the emperor Charles V, which was published, with a learned commentary, by M. Sprengel, in 1795. Neither Columbus (1498) nor Alonzo de Ojeda, accompanied by Amerigo Vespucci (1499), had seen the real mouth of the Orinoco; they confounded it with the northern opening of the Gulf of Paria, to which they attributed (by an exaggeration so common to the navigators of that time, an immense volume of fresh water. It was Vicente Yanez Pinçon, who, after having discovered the mouth of the Rio Marañon, $\dagger$ first saw, in 1500, that of the Orinoco. He called this river Rio Dolce-a name which, since Ribeyro, was long preserved on our maps, and which has sometimes been given erroneously to the Maroni and to the Essequibo.
The great Lake Parima did not appear on our maps $\ddagger$ till

* Alexandri Geraldini Itinerarium, p. 250.
$\dagger$ The name of Marañon was known fifty-nine years before the expedition of Lopez de Aguirre; the denomination of the river is therefore erroneously attributed to the nickname of maraños (hogs), which this adventurer gave his companions in going down the river Amazon. Was not this vulgar jest rather an allusion to the Indian name of the river?
$\ddagger$ I find no trace of it on a very rare map, dedicated to Richard Hakluyt, and constructed on the meridian of Toledo. (Novus Orbis, Paris, 1587.) In this map, published before the voyage of Quiros, a group of islands is marked (Infortrnate Insulas) where the Friendly Islands actually are. Ortelius ( 1570 ) already knew them. Were they islands seen by Magellan?
after the first voyage of Raleigh. It was Jodocus Hondius who, as early as the year 1599, fixed the ideas of geographers; and figured the interior of Spanish Guiana as a country well known. He transformed the isthmus between the Rio Branco and the Rio Rupunuwini (one of the tributary streams of the Essequibo) into the lake Rupunuwini, Parima, or Dorado, two hundred leagues long, and forty broad, and bounded by the latitudes of $1^{\circ} 4.5^{\prime}$ south, and $2^{\circ}$ north. This inland sea, larger than the Caspian, is sometimes traced in the midst of a mountainous country, without communication with any river;* and sometimes the Rio Oyapok (Waiapago, Japoc, Viapoco) and the Rio de Cayana are made to issue from it. $\dagger$ 'I'he first of these rivers, confounded in the eighth article of the treaty of Utrecht with the Rio de Vicente Pinçon (Rio Calsoëne of D'Anville), has been, even down to the late congress of Vienna, the subject of interminable discussions between the French and Portuguese diplomatists. $\ddagger$ The second is an imaginary prolongation either of the Tonnegrande or of the Oyac (Wia $?$ ). The inland sea (Laguna Parme) was at first placed in such a manner, that its western extremity coincided with the meridian of the confluence of the Apure and the Orinoco. By degrees it was advanced toward the east, § the western extremity being found to the south of the mouth of the Orinoco. This change produced others in the respective situations of the lakes Parima and Cassipa, as well as in the direction of the course of the Orinoco. This great river is represented as running, from its delta as far as beyond the

[^373]Meta, from south to north, like the river Magdalena. The tributary streams, therefore, which were made to issue from the lake Cassipa, the Carony, the Arui, and the Caura, then took the direction of the latitude, while in nature they follow that of a meridian. Beside the lakes Parıma and Cassipa, a third was traced upon the maps, from which the Aprouague (Apurwaca) was made to issue. It was then a general practice among geographers to attach all rivers to great lakes. By this means Ortelius joined the Nile to the Zaire or Rio Congo, and the Vistula to the Wolga and the Dnieper. North of Mexico, in the pretended kingdoms of Quivira and Cibola, rendered celebrated by the falsehoods of the monk Marcos de Niza, a great inland sea was imagined, from which the Rio Colorado of California was made to issue.* A branch of the Rio Magdalena flowed to the Laguna de Maracaybo; and the lake of Xaraycs, near which a southern Dorado was placed, communicated with the Amazon, the Miarit (Meary), and the Rio de San Francisco. These hydrographic reveries have for the most part disappeared; but the lakes Cassipa and Dorado have been long simultaneously preserved on our maps.

In following the history of geography we see the Cassipa, figured as a rectangular parallelogram, enlarge by degrees at

* This is the Mexican Dorado, where it was pretended, that vessels had been found on the coasts [of New Albion ?] loaded with the merchandise of Catayo and China (Gomara, Hist. Gen., p. 117), and where Fray Marcos (like Huten in the country of the Omaguas) had seen from ofar the gilded roofs of a great town, one of the Siete Ciudades. The inhabitants have great dogs, "en los quales quando se mudan cargan su menage." (Herrera, dec. VI, p. 157, 206.) Later discoveries, however, leave no doubt that there existed a centre of civilization in those countries.
$\dagger$ As this river flows into the gulf of Maranhão (so named because some French colonists, Rifault, De Vaux, and Ravadière, believed they were opposite the month of the Marañon or Amazon), the ancient maps call the Meary Marañon, or Maranham. (See the maps of Hondius, and Paulo de Forlani.) Perhaps the idea that Pinçon, to whom the discuvery of the real Marañon is due, had landed in these parts, since become celebrated by the shipwreck of Ayres da Cunha, has also contributed to this confusion. The Meary appears to me identical with the Rio de Vicente Pingon of Diego Ribeyro, which is more than one hundred and forty leagues from that of the modern geographers. At present the name of Marañon has remained at the same time to the river of the Amazons, and to a province much farther eastward, the capital of which is MaranLão, or St. Louis de Marañon.
the expense of El Dorado. While the latter is sometimes suppressed, no one ventures to touch the former,* which is the Rio Paragua (a tributary stream of the Caroni) enlarged by temporary inundations. When D'Anville learned from the expedition of Solano, that the sources of the Orinoco, far from lying to the west, on the back of the Andes of Pasto, came from the east, from the mountains of Parima, he restored in the second edition of his fine map of America (1760) the Laguna Parime, and very arbitrarily made it to communicate with three rivers, the Orinoco, the Rio Branco, and the Essequibo, by the Mazuruni and the Cujuni; assigning to it the latitude from $3^{\circ}$ to $4^{\circ}$ north, which had till then been given to lake Cassipa.

I have now stated, as I announced above, the variable forms which geographical errors have assumed at different periods. I have explained what in the configuration of the soil, the course of the rivers, the names of the tributary streams, and the multiplicity of the portages, may have given rise to the hypothesis of an inland sea in the centre of Guiana. However dry discussions of this nature may appear, they ought not to be regarded as sterile and fruitless. They show travellers what remains to be discovered; and make known the degree of certainty which long-repeated assertions may claim. It is with maps; as with those tables of astronomical positions which are contained in our ephemerides, designed for the use of navigators : the most heterogeneous materials have been employed in their construction during a long space of time; and; without the aid of the history of geography, we could scarcely hope to discover at some future day on what-authority every partial statement rests.

Before I resume the thread of my narrative, it remains for me to add a few general reflections on the auriferous lands situate between the Amazon and the Orinoco. We have just shown that the fable of 'En Dorado, like the most celebrated fables of the nations of the ancient world, has been applied progressively to different spots. We have seen it advance from the south-west to the north-east, from the oriental declivity of the Andes towards the plains of

[^374]Rio Branco and the Essequibo, an identical direction with that in which the Caribs for ages conducted their warlike and mercantile expeditions. It may be conceived that the gold of the Cordilleras might be conveyed from hand to hand, through an infinite number of tribes, as far as the shore of Guiana; since, long before the fur-trade had attracted English, Russian, and American vessels to the northwest coast of America, iron tools had been carried from New Mexico and Canada beyond the Rocky Mountains. From an error in longitude, the traces of which we find in all the maps of the 16th century, the auriferous mountains of Peru and New Granada were supposed to be much nearer the months of the Orinoco and the Amazon than they are in fact. Geographers have the habit of augmenting and extending beyond measure countries that are recently discovered. In the map of Peru, published at Verona by Paulo di Forlani, the town of Quito is placed at the distance of 400 leagues from the coast of the South Sea, on the meridian of Cumana; and the Cordillera of the Andes there fills almost the whole surface of Spanish, French, and Datch Guiana. This erroneous opinion of the breadth of the Andes has no doubt contributed to give so much importance to the granitic plains that extend on their eastern side: Unceasingly confounding the tributary streams of the Amazon with those of the Orinoco, or (as the lieutenstats of Raleigh called it, to flatter their chief) the Rio Raleana, to the latter were attributed all the traditions which had been collected respecting the Dorado of Quixos, the Omaguas, and the Manoas.* The geographer Hondius

[^375]supposed that the Andes of Loxa, celebrated for their forests of cinchona, were only twenty leagues distant from the lake Parima, or the banks of the Rio Branco. This proximity procured credit to the tidings of the flight of the Inca into the forests of Guiana, and the removal of the treasures of Cuzco to the easternmost parts of that country. No doubt in going up towards the east, either by the Meta or by the Amazon, the civilization of the natives, between the Puruz, the Jupura, and the Iquiari, was observed to increase. They possessed amulets, little idols of molten gold, and chairs, elegantly carved; but these traces of dawning civilization are far distant from those cities and houses of stone described by Raleigh and those who followed him. We have made dravings of some ruins of great edifices east of the Cordilleras, when going down from Loxa towards the Amazon, in the province of Jaen de Bracamoros; and thus far the Incas had carried their arms, their religion, and their arts. The inhabitants of the Orinoco were also, before the conquest, when abandoned to themselves, somewhat more civilized than the independent hordes of our days. They had populous villages along the river, and a regular
success against the Spaniards. He retired at length into the mountains and thick forests of Vilcabamba, which are accessible either by Huamanga and Antabuaylla, or by the valley of Yucay, north of Cuzco. Of the troo sons of Manco-Inca, the eldest, Sayri-Tupac, surrendered himself to the Spaniards, upon the invitation of the viceroy of Peru, Hurtado de Mendoza. He was received with great pomp at Lima, was baptized there, and died peaceably in the fine valley of Yucay. The youngest son of Manco-Inca, Tupac-A maru, was carried off by stratagem from the forests of Vilcabamba, and beheaded on pretext of a conspiracy formed against the Spanish usurpers. At the same period, thirty-five distant relations of the Inca Atahualpa were seized, and conveyed to Lima, in order to remain under the inspection of the Audiencia. (Garcilasso, vol. ii, p. 194, 480, and 501.) It is interesting to inquire whether any other princes of the family of Manco-Capac have remained in the forests of Vilcabamba, and if there still exist any descendants of the Incas of Peru between the Apurimac and the Beni. This supposition gave rise in 1741 to the famous rebellion of the Chuncoes, and to that of the Amages and Campoes led on by their chief Juan Santos, called the false Atahualpa. The late political events of Spain have liberated from prison the remains of the family of Jose Gabriel Condorcanqui, an artful and intrepid man, who, under the name of the Inca Tupac-Amaru, attempted in 1781 that restoration of the ancient dynasty which Raleigh had projected in the time of Queen Elizabeth.
trade with more southern nations; but nothing indicates that they ever constructed an edifice of stone. We saw no vestige of any during the course of our journey.
Though the celebrity of the riches of Spanish Guiana is chiefly assignable to the geographical situation of the country, and the errors of the old maps, we are not justified in denying the existence of any auriferous land in the tract of country of eighty-two thousand square leagues, which stretches between the Orinoco and the Amazon, on the east of the Andes oí Quito and New Granada. What I saw of this country between the second and eighth degrees of latitude, and the sixty-sixth and seventy-first degrees of longitude, is entirely composed of granite, and of a gneiss passing into micaceous and talcous slate. These rocks appear naked in the lofty mountains of Parima, as well as in the plains of the Atabapo and the Cassiquiare. Granite predominates there over the other rocks; and though, in both continents, the granite of ancient formation is pretty generally destitute of gold-ore, we cannot thence conclude that the granite of Parima contains no vein, no stratum of auriferous quartz. On the east of the Cassiquiare, towards the sources of the Orinoco, we observed that the number of these strata and these veins increased. The granite of these countries, by its structure, its mixture of hornblende, and other geological features alike important, appears to me to belong to a more recent formation, perhaps posterior to the gneiss, and analogous to the stanniferous granites, the hyalomictes, and the pegmatites. Now the least ancient granites are also the least destitute of metals; and several auriferous rivers and torrents in the Andes, in the Salzburg, Fichtelgebirge, and the table-land of the two Castiles, lead us to believe that these granites sometimes contain native gold, and portions of auriferous pyrites and galena disseminated throughout the whole rock, as is the case with tin and magnetic and micaceous iron. The group of the mountains of Parima, several summits of which attain the height of one thousand three hundred toises, was almost entirely unknown before our visit to the Orinoco. This group, however, is a hundred leagues long, and eighty broad ; and though wherever M. Bonpland and I traversed this vast group of mountains, its structure seemed to us extremely uniform, it would be wrong to affirm
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that it may not contain very metalliferous transition rochs and mica-slates superimposed on the granite.

I have already observed, that the silvery lustre and frequency of mica have contributed to give Guiana great celebrity for metallic wealth. The peak of Calitamini, glowing every evening at sunset with a reddish fire, still attracts the attention of the inhabitants of Maypures. According to the fabulous stories of the natives, the islets of mica-slate, situate in lake Amucu, augment by their reflection the lustre of the nebulæ of the southern sky. "Every mountain," says Raleigh, "every stone in the forests of the Orinoco, shines like the precious metals; if it be not gold, it is madre del oro (mother of gold)." Raleigh asserts that he brought back gangues of auriferous white quartz ("harde white sparr") ; and to prove the richness of this ore, he gives an account of the assays that were made by the officers of the mint at London.* I have no reason to believe that the chemists of that time sought to lead Queen Elizabeth into error, and I will not insult the memory of Raleigh by supposing, like his contemporaries, $\dagger$ that the auriferous quartz which he brought home, had not been collected in America. We cannot judge of things from which we are separated by so long an interval of time. The gneiss of the littoral chain $\ddagger$ contains traces of the precious metals; and some grains of gold have been found in the mountains of Parima, near the mission of Encaramada. How can we infer the absolute sterility of the primitive rocks of Guiana from testimony merely negative, from the circumstance, that during a journey of three months we saw no auriferous vein appearing above the soil?

In order to bring together whatever may enlighten the government of this country on a subject so long disputed, I will enter upon a few more geological considerations. The mountains of Brazil, notwithstanding the numerous traces of imbedded ore which they display between Saint Paul and Villa

[^376]Rica, have furnished only stream-works of gold. More than six-sevenths of the seventy-eight thousand marks ( $52,000 l$.) of this metal, with which at the beginning of the 19th century America annually supplied the commerce of Europe, have come, not from the lofty Cordilleras of the Andes, but from the alluvial lands on the east and west of the Cordilleras. These lands are raised but little above the level of the sea, like those of Sonora in Mexico, and of Choco and Barbacoas in New Granada; or they stretch along in table-lands, as in the interior of Brazil.* Is it not probable that some other depositions of auriferous earth extend toward the northern hemisphere, as far as the banks of the Upper Orinoco and the Rio Negro, two rivers which form but one basin with that of the Amazon? I observed, when speaking of El Dorado de Cañelas, the Omaguas, and the Iquiare, that almost all the rivers which flow from the west wash down gold in abundance, and very far from the Cordilleras. From Loxa to Popayan these Cordilleras are composed alternately of trachytes and primitive rocks. The plains of Ramora, of Logrono, and of Macas (Sevilla del Oro), the great Rio Napo with its tributary streamst (the Ansupi and the Coca, in the province of Quisos), the Caqueta de Mocoa as far as the mouth of the Fragua, in fine, all the country comprised between Jaen de Bracamoros and the Guaviare, $\ddagger$ preserve their ancient celebrity for metallic wealth. More to the east, between the sources of the Guainia (Rio Negro), the Uaupes, the Iquiare, and the Yurubesh, we find a soil in-

[^377]contestably auriferous. There Acunha and Father Fritz placed their Laguna del Oro; and various accounts, which I obtained at San Carlos from Portuguese Americans, explain perfectly what La Condamine has related of the plates of beaten gold found in the hands of the natives. If we pass from the Iquiare to the left bank of the Rio Negro, we enter a country entirely unknown, between the Rio Branco, the sources of the Essequibo, and the mountains of Portuguese Guiana. Acunha speaks of the gold washed down by the northern tributary streams of the Lower Marañon, such as the Rio Trombetas (Oriximina), the Curupatuba, and the Ginipape (Rio de Paru). It appears to me a circumstance worthy of attention, that all these rivers descend from the same table-land, the northern slope of which contains the lake Amucu, the Dorado of Raleigh and the Dutch, and the isthmus between the Rupunuri (Rupunuwini) and the Rio Mahu. There is no reason for denying the existence of auriferous alluvial lands far from the Cordilleras of the Andes, on the north of the Amazon; as there are on the south, in the mountains of Brazil. The Caribs of the Carony, the Cuyuni, and the Essequibo, have practised on a small scale the washing of alluvial earth from the remotest times.* When we examine the structure of mountains, and embrace in one point of view an extensive surface

[^378]of the globe, distances disappear; and places the most remote insensibly draw near each other. The basin of the Upper Orinoco, the Rio Negro, and the Amazon, is bounded by the mountains of Parime on the north, and by those of Miñas Geraes, and Matogrosso on the south. The opposite slopes of the same valley often display an analogy in their geological relations.

I have described in this and the preceding volume the vast provinces of Venezuela and Spanish Guiana. While examining their natural limits, their climate, and their productions, I have discussed the influence produced by the configuration of the soil on agriculture, commerce, and the more or less rapid progress of society. I have successively passed over the three regions that succeed each other from north to south; from the Mediterranean of the West Indies to the forests of the Upper Orinoco and of the Amazon. The fertile land of the shore, the centre of agricultural riches, is succeeded by the Llanos, inhabited by pastoral tribes. These Llanos are in their turn bordered by the region of forests, the inhabitants of which enjoy, 1 will not say liberty, which is always the result of civilization, but a sort of savage independence. On the limit of these two latter zones the struggle now exists which will decide the emancipation and future prosperity of America. The changes which are preparing cannot efface the individual character of each region; but the manners and condition of the inhabitants will assume a more uniform colour. This consideration perhaps adds interest to a tour made in the beginning of the nineteenth century. We like to see, traced in the same picture, the civilized nations of the sea-shore, and the feeble remains of the natives of the Orinoco, who know no. other worship than that of the powers of nature; and who, like the ancient Germans, deify the mysterious object which excites their simple admiration.*

[^379]
## Chapter XXVI.

The Llanos del Pao, or eastern part of the Plains of Venezuela.-Mis. sions of the Caribs.-Last visit to the Coast of Nueva Barcelona, Cumana, and Araya.

Night had set in when we crossed for the last time the bed of the Orinoco. We purposed to rest near the little fort San Rafael, and on the following morning at daybreak to set out on our journey through the plains of Venezuela. Nearly six weeks had elapsed since our arrival at Angostura; and we earnestly wished to reach the coast, with the view of finding, at Cumana, or at Nueva Barcelona, a vessel in which we might embark for the island of Cuba, thence to proceed to Mexico. After the sufferings to which we had been exposed during several months, whilst sailing in small boats on rivers infested by mosquitos, the idea of a seavuyage was not without its charms. We had no idea of ever again returning to South America. Sacrificing the Andes of Peru to the Archipelago of the Philippines, (of which so little is known,) we adhered to our old plan of remaining a year in New Spain, then proceeding in a galleon from Acapulco to Manilla, and returning to Europe by way of Bassora and Aleppo. We imagined that, when we had once left the Spanish possessions in America, the fall of that ministry which had procured for us so many advantages, could not be prejudicial to the execution of our enterprise.

Our mules were in waiting for us on the left bank of the Orinoco. The collection of plants, and the different geological series, which we had brought from the Esmeralda and Rio Negro, had greatly augmented our baggage; and, as it would have been dangerous to lose sight of our herbals, we expected to make a very slow journey across the Llanos. The heat was excessive, owing to the reverberation of the soil, which was almost everywhere destitute of vegetation; yet the centigrade thermometer during the day (in the shade) was only from thirty to thirty-four degrees, and during the night, from twenty-seven to twenty-eight degrees. Here, therefore, as almost everywhere within the tropics, it was less the absolute degree of heat, than its duration, that
affected our sensations. We spent thirteen days in crossing the plains, resting a little in the Caribbee (Caraibes) missions, and in the little town of Pao. The eastern part of the Llanos, through which we passed, between Angostura and Nueva Barcelona, presents the same wild aspect as the western part, through which we had passed from the valleys of Aragua to San Fernando de Apure. In the season of drought, (which is here called summer,) though the sun is in the southern hemisphere, the breeze is felt with greater force in the Llanos of Cumana, than in those of Caracas; because those vast plains, like the cultivated fields of Lombardy, form an inland basin, open to the east, and elosed on the north, south, and west, by high chains of primitive mountains. Unfortunately, we could not avail ourselves of this refreshing breeze, of which the Llaneros, or the inhabitants of the plains, speak with rapture. It was now the rainy season north of the equator; and though it did not rain in the plains, the change in the declination of the sun had for some time caused the action of the polar currents to cease. In the equatorial regions, where the traveller may direct his course by observing the direction of the clouds, aud where the oseillations of the mercury in the barometer indicate the hour almost as well as a clock, everything is subject to a regular and uniform rule. The cessation of the breezes, the setting-in of the rainy season, and the frequency of electric explosions, are phenomena which are found to be connected together by immutable laws.

On entering the Llanos of Nueva Barcelona, we met with a Frenchman, at whose house we passed the first night, and who received us with the kindest hospitality. He was a native of Lyons, and he had left his country at a very early age. He appeared extremely indifferent to all that was passing beyond the Atlantic, or, as they say here, disdainfully enough, when speaking of Europe, " on the other side of the great pool" (al otro lado del charco). Our host was employed in joining large pieces of wood by means of a kind of glue called guayca. This substance, which is used by the carpenters of Angostura, resembles the best animal glue. It is found perfectly prepared between the bark and the alburnum of a creeper* of the family of the Combretacem. It

* Combretum guayea.
probably resembles in its chemical properties birdlime, the vegetable principle obtained trom the berries of the mistletoe, and the internal bark of the holly. An astonishing abundance of this glutinous matter issues from the twining branches of the vejuco de guayca when they are cut. Thus, we find within the tropics a substance in a state of purity, and deposited in peculiar organs, which in the temperate zone can be procured only by artificial means.
We did not arrive until the third day at the Caribbee missions of Cari. We observed that the ground was less cracked by the drought in this country than in the Llanos of Calabozo. Some showers had revived the vegetation. Small gramina, and especially those herbaceous seusitiveplants so useful in fattening half-wild cattle, formed a thick turf. At great distances one from another, there arose a few fan-palms (Corypha tectorum), rhopalas* (chaparro), and malpighias $\dagger$ with coriaceous and glossy leaves. The humid spots are recognized at a distance by groups of mauritia, which are the sago-trees of those countries. Near the coast this palm-tree constitutes the whole wealth of the Guaraon Indians; and it is somewhat remarkable that we also found it one hundred and sixty leagues farther south, in the midst of the forests of the Upper Orinoco, in the savannahs that surround the granitic peak of Duida. $\ddagger$ It was loaded at this season with enormous clusters of red fruit, resembling fir-cones. Our monkeys were extremely fond of this fruit, which has the taste of an over-ripe apple. The monkeys were placed with our baggage on the backs of the mules, and they made great efforts to reach the clusters that hung over their heads. The plain was undulating from the effects of the mirage; and when, after travelling for an hour, we reached the trunks of the palm-trees, which appeared like masts in the horizon, we observed with

[^380]astonishment how many things are connected with the existence of a single plant. The winds, losing their velocity when in contact with the foliage and the branches, accumulate sand around the trunk. The smell of the fruit, and the brightness of the verdure, attract from afar the birds of passage, which love to perch on the slender, arrow-like branches of the palm-tree. A soft murmuring is heard around; and overpowered by the heat, and accustomed to the melancholy silence of the plains, the traveller imagines he enjoys some degree of coolness on hearing the slightest sound of the foliage. If we examine the soil on the side opposite to the wind, we find it remains humid long after the rainy season. Insects and worms, everywhere else so rare in the Llanos, here assemble and multiply. This one solitary and often stunted tree, which would not claim the notice of the traveller amid the forests of the Orinoco, spreads life around it in the desert.

On the 13th of July we arrived at the village of Cari, the first of the Caribbee missions that are under the Observantin monks of the college of Piritu. We lodged as usual at the convent, that is, with the clergyman. Our host could scarcely comprehend "how natives of the north of Europe could arrive at his dwelling from the frontiers of Brazil by the Rio Negro, and not by way of the coast of Cumana." He behaved to us in the most affable manner, at the same tine manifesting that somewhat importunate curiosity which the appearance of a stranger, not a Spaniard, always excites in South America. He expressed his belief that the minerals we had collected must contain gold; and that the plants, dried with so much care, must be medicinal. Here, as in many parts of Europe, the sciences are thought worthy to occupy the mind only so far as they confer some immediate and practical benefit on society.
We found more than five hundred Caribs in the village of Cari; and saw many others in the surrounding missions. It is curious to observe this nomade people, recently attached to the soil, and differing from all the other Indians in their physical and intellectual powers. They are a very tall race of men, their height being from five feet six inches, to five feet ten inches. According to a practice common in America, the women are more sparingly clothed than the men.

The former wear only the guajuco, or perizoma, in the form of a band. The men have the lower part of the body wrapped in a pieee of blue cloth, so dark as to be almost black. This drapery is so ample, that, on the lowering of the temperature towards evening, the Caribs throw it over their shoulders. Their bodies tinged with onoto,* their tall figures, of a reddish copper-colour, and their picturesque drapery, when seen from a distance, relieved against the sky as a background, resemble antique statues of bronze. The men cut their hair in a very peculiar manner, very much in the style of the monks. A part of the forehead is shaved, which makes it appear extremely high, and a circular tuft of hair is left near the crown of the head. This resemblance between the Caribs and the monks is not the result of mission life. It is not caused, as had been erroneously supposed, by the desire of the natives to imitate their masters, the Franciscan monks. The tribes that have preserved their wild independence, between the sources of the Carony and the Rio Branco, are distinguished by the same cerquillo de frailes, $\dagger$ which the early Spanish historians at the time of the discovery of America attributed to the nations of the Carib race. All the men of this race whom we saw either during our voyage on the Lower Orinoco, or in the missions of Piritu, differ from the other Indians not only in the tallness of their stature, but also in the regularity of their features. Their noses are smaller, and less flattened; the cheek-bones are not so high; and their physiognomy has less of the Mongol character. Their eyes, which are darker than those of the other hordes of Guiana, denote intelligence, and it may even be said, the habit of reflection. The Caribs have a gravity of manner, and a certain look of sadness which is observable among most of the primitive inhabitants of the New World. The expression of severity in their features is heightened by the practice of dyeing their eyebrows with the juice of caruto: they also lengthen their eyebrows, thereby giving them the appearance of being joined together; and they often mark their faces all over with black spots to give themselves a more fierce appearance. The

* Rocou, obtained from the Bixa orellana. This paint is called in th. Carib tongue, bichet.
$\dagger$ Eircular tonsure of the friars.

Carib women are less robust and good-looking than the men. On them devolves almost the whole burden of domestic work, as well as much of the out-door labour. They asked us eagerly for pins, which they stuck under their lower lip, making the head of the pin penetrate deeply into the skin. The young girls are painted red, and are almost naked. Among the different nations of the old and the new worlds, the idea of nudity is altogether relative. A woman in some parts of Asia is not permitted to show the tips of her fingers; while an Indian of the Carib race is far from considering herselt unclothed if she wear round her waist a guajuco two inches broad. Even this band is regarded as less essential than the pigment which covers the skin. To go out of the hat without being painted, would be to transgress all the rules of Carib decency.

The Indians of the missions of Piritu especially attracted our attention, because they belong to a nation which, by its daring, its warlike enterprises, and its mercantile spirit, has exercised great influence over the rast country extending from the equator towards the northern coast. Everywhere on the Orinoco we beheld traces of the hostile incursions of the Caribs: incursions which heretofore extended from the sources of the Carony and the Erevato as far as the banks of the Ventuari, the Atacavi, and the Rio Negro. The Carib language is consequently the most general in this part of the world; it has even passed (like the language of the Lenni-Lenapes, or Algonkins, and the Natchez or Muskoghees, on the west of the Alleghany mountains) to tribes which have not a common origin.

When we survey that multitude of nations spread over North and South America, eastward of the Cordilleras of the Andes, we fix our attention particularly on those who, having long held dominion over their neighbours, have acted an important part on the stage of the world. It is the business of the historian to group facts, to distinguish masses, to ascend to the common sources of many migrations and popular movements. Great empires, the regular organization of a sacerdotal hierarchy, and the culture which that organization favours in the first ages of society, have existed only on the high mountains of the western world. In Mexico we see a vast monarchy enclosing small republics; at Cun-
dinamarca and Peru, we find pure theocracies. Fortified towns, highways and large edifices of stone, an extraordinary development of the feudal system, the separation of castes, convents of men and women, religious congregations regulated by discipline more or less severe, complicated divisions of time connected with the calendars, the zodiacs, and the astrology of the enlightencd nations of Asia,-all these phenomena, in America, belong to one region only, the long and narrow Alpine band extending from the thirtieth degree of north latitude to the twenty-fifth degree of south. The migration of nations in the ancient world was from east to west; the Basques or Iberians, the Celts, the Germans, and the Pelasgi, appeared in succession. In the New World similar migrations flowed from north to south. Among the nations that inhabit the two hemispheres, the direction of this movement followed that of the mountains; but, in the torrid zone, the temperate table-lands of the Cordilleras had greater influence on the destiny of mankind, than the mountains of Asia and central Europe. As, properly speaking, only civilized nations have a history, the history of the Americans is necessarily no more than that of a small portion of the inhabitants of the mountains. Profound obscurity envelops the vast country which stretches from the eastern slope of the Cordilleras towards the Atlantic; and for this very reason, whatever in that country relates to the preponderance of one nation over others, to distant migrations, to the physiognomical features which denote a foreign race, excite our deepest interest.

Amidst the plains of North America, some powerful nation, which has disappeared, constructed circular, square, and octagonal fortifications; walls six thousand toises in length; tumuli from seven to eight hundred feet in diameter, and one hundred and forty feet in height, sometimes round, sometimes with several stories, and containing thousands of skeletons. These skeletons are the remains of men less slender, and more squat, than the present inhabitants of those countries. Other bones wrapped in fabrics resembling those of the Sandwich and Feejee Islands, are found in the natural grottoes of Kentucky. What is become of those nations of Louisiana anterior to the Lenni-Lenapes, the Shawanese, and perhaps even to the Sioux (Nadowesses,

Nahcotas) of the Missouri, who are strongly mongolised; and who, it is believed, according to their own traditions, came from the coast of Asia? In the plains of South America we find only a very few hillocks of that kind called cerros hechos a mano;* and nowhere any works of fortification analogous to those of the Ohio. However, on a vast space of ground, at the Lower Orinoco, as well as on the banks of the Cassiquiare and between the sources of the Essequibo and the Rio Branco, there are rocks of granite covered with symbolic figures. These sculptures denote that the extinct generations belonged to nations different from those which now inhabit the same regions. There seems to be no connection between the history of Mexico, and that of Cundinamarca and of Peru; but in the plains of the east a warlike and long-dominant nation betrays in its features, and its physical constitution, traces of a foreign origin. The Caribs preserve traditions that seem to indicate ancient communications between North and South America. Such a phenomenon deserves particular attention. If it be true that savages are for the most part degenerate races, remnants escaped from a common wreck, as their languages, their cosmogonic fables, and numerous other indications seem to prove, it becomes doubly important to examine the course by which these remnants have been driven from one hemisphere to the other.
That fine race of people, the Caribs, now occupy only a small part of the country which they inhabited at the time of the discovery of America. The cruelties exercised by Europeans have entirely exterminated them from the West India Islands, and the coasts of Darien; while under the government of the missions, they have formed populous villages in the provinces of New Barcelona and Spanish Guiana. The Caribs who inhabit the Llanos of Piritu, and the banks of the Carony and the Cuyuni, may be estimated at more than thirty-five thousand. If we add to this number the independent Caribs, who live westward of the mountains of Cayenne and Pacaraymo, between the sources of the Essequibo and the Rio Branco, we shall no doubt obtain a total of forty thousand individuals of pure race, unmixed with any other tribes of natives. Prior to my travels,

[^381]the Caribs were mentiomed in many geographical works as an extinct race. Writers unacquainted with the interior of the Spanish colones of the continent, supposed, that the small islands of Dominica, Guadaloupe, and St. Vincent, had been the principal abodes of that nation of which the only vestiges now remaining throughout the whole of the eastern West India Islands are skeletons petrified, or rather enveloped in a limestone containing madrepores.*
The name of Caribs, which I find for the first time in a letter of Peter Martyr d'Anghiera is derived from Calina and Caripuna, the $l$ and $p$ being transferred into $r$ and $b$. It is very remarkable, that this name, which Columbus heard pronounced by the people of Hayti, was known to exist at the same time among the Caribs of the islands and those of the continent. From the word Carina, or Calina, has been formed Galibi (Caribi). This is the distinctive denomination of a tribe in French Guiana, $\dagger$ who are of much more diminutive stature than the inhabitants of Cari, but speaking one of the numerous dialects of the Carib tongue. The inhabitants of the islands are called Calinago in the language of the men ; and in that of the women, Callipinan. The differenoe in the language of the two sexes is more striking among the people of the Carib race, than among other American nations (the Omaguas, the Guaranis, and the Chiquitos), where it applies only to a limited number of ideas; for instance, the words mothen and child. It may be conceived that women, from their separate way of life, frame particular terms, which men do not adopt. Cicero observes, $\ddagger$ that old forms of language are best preserved by women, because by

* These skeletons were discovered in 1805 by M. Cortes. They are encased in a formation of madrepore breccia, which the negroes call "God's masonry," and which, like the travertin of Italy, envelops fragments of vases and other objects created by human skill. M. Dauxion Lavaysse and Dr. Kœnig first made known in Europe this phenomenon, which has greatly interested geologists.
$\dagger$ The Galibis (Calibitis), the Palicours, and the Acoquouas, also cut their hair in the style of the monks; and apply bandages to the legs of their children, for the purpose of swelling the muscles. They have the same predilection for green stones (saussurite), which we observed among the Carib nations of the Orinoco. There exist, besides, in French Guiana, twenty Indian tribes, which are distinguished from the Galibis, though their language proves that they have a common origin.
$\ddagger$ Cicero, de Orat., lib. III. cap. xii. § 45, ed. Verburg. "Facilius
their position in society they are less exposed to those vicissitudes of life, changes of place and occupation, which tend to corrupt the primitive purity of language among men. But in the Carib nations the contrast between the dialect of the two sexes is so great, that to explain it satisfactorily we must refer to another cause ; and this may perhaps be found in the barbarous custom, practised by those nations, of killing their male prisoners, and carrying the wives of the vanquished into captivity. When the Caribs made an irruption into the archipelago of the West India Islands, they arrived there as a band of warriors, not as colonists accompanied by their families. The language of the female sex was formed by degrees, as the conquerors contracted alliances with the foreign women ; it was composed of new elements, words distinct from the Carib words,* which in the interior of the gynaceums were transmitted from generation to generation, but on which the structure, the combinations, the grammatical forms of the language of the men exercised an influence. There was then manifested in a small community the peouliarity which we now find in the whole group of the nations of the New Continent. The American languages, from Hudson's Bay to the Straits of Magellan, are in general characterized by a total disparity of words combined with a great analogy in their structure. They are like different substances invested with analogous forms. If we recollect that this phenomenon extends over one-half of our planet, almost from pole to pole; it we consider the shades in the grammatical forms (the genders applied to the three persons of the verb, the reduplications, the frequentatives, the duals) ; it appears highly astonishing to find a uniform tendency in the development of intelligence and language among so considerable a portion of the human race.
We have just seen that the dialect of the Carib women, in the West India Islands, contains the vestiges of a language that was extinct. Some writers have imagined that this extinct language might be that of the Ygneris, or primitive

[^382]inhabitants of the Caribbee Islands; others have traced in it some resemblance to the ancient idiom of Cuba, or to those of the Arowaks, and the Apalachites in Florida: but these hypotheses are all founded on a very imperfect knowledge of the idioms which it has been attempted to compare one with another.

The Spanish writers of the sixteenth century inform us that the Carib nations then extended over eighteen or nineteen degrees of latitude, from the Virgin Islands east of Porto Rico, to the mouths of the Amazon. Another prolongation toward the west, along the coast-chain of Santa Marta and Venezuela, appears less certain. Gomara, however, and the most ancient historians, give the name of Caribana, not, as it has since been applied, to the country between the sources of the Orinoco and the mountains of French Guiana, ${ }^{\text {, }}$ but to the marshy plains between the mouths of the Rio Atrato and the Rio Sinu. I have visited those coasts in going from the Havannah to Porto Bello; and I there learned, that the cape which bounds the gulf of Darien or Uraba on the east, still bears the name of Punta Caribana. An opinion heretofore prevailed pretty generally, that the Caribs of the West India Islands derived their origin, and even their name, from these warlike people of Darien. "From the eastern shore springs Cape Uraba, which the natives call Caribana, whence the Caribs of the island are said to have received their present name." $\dagger$ Thus Anghiera expresses himself in his "Oceanica." He had been told by a nephew of Amerigo Vespucci, that thence, as far as the snowy mountains of St. Marta, all the natives were "e genere Caribium, vel Canibalium." I do not deny that Caribs may have had a settlement near the gulf of Darien, and that they may have been driven thither

* This name is found in the map of Hondius, of 1599, which accompanies the Latin edition of the narrative of Raleigh's voyage. In the Dutch edition (Nieuwe Caerte van het goudrycke landt Guiana), the Llanos of Caracas, between the mountains of Merida and the Rio Pao, bear the name of Caribana. We may remark here, what we observe so often in the history of geography, that the same denomination has spread by degrees from west to east.
$\dagger$ "Inde Vrabam ab orientali prehendit ora, quam appellant indigenæe Caribana, unde Caribes insulares originem habere nomenque retinere dicuntur."
by the easterly currents; but it also may have happened, that the Spanish navigators, little attentive to languages, gave the names Carib and Cannibal to every race of people of tall stature and ferocious character. Still it is by no, means probable that the Caribs of the islands and of Parima took to themselves the name of the region which they had originally inhabited. On the east of the Andes, and wherever civilization has not yet penetrated, it is the people who have given names to the places where they have settled.* The words Caribs and Cannibals appear significant; they are epithets referring to valour, strength, and even superior intelligence. $\dagger$ It is worthy of remark, that, at the arrival of the Portuguese, the Brazilians gave to their magicians the name of caraibes. We know that the Caribs of Parima were the most wandering people of America; possibly some wily individuals of that nation played the same part as the Chaldeans of the ancient continent. The names of nations readily become affixed to particular professions; and when, in the time of the Cæsars, the superstitions of the East were introduced into Italy, the Chaldeans no more came from the banks of the Euphrates than our Gypsies (Egyptians or Bohemians) came from the banks of the Nile or the Flbe.

When a continent and its adjacent islands are peopled by one and the same race, we may choose between two hypotheses; supposing the emigration to have taken place either from the islands to the continent, or from the continent to the islands. The Iberians (Basques), who were settled at the same time in Spain and in the islands of the Mediterranean, afford an instance of this problem; as do also the Malays, who appear to be indigenous in the peninsula of Malacca, and in the district of Menangkabao in the island of Sumatra. $\ddagger$ The archipelago of the large and small West India Islands forms a narrow and broken neck of land,

[^383]parallel with the isthmus of Panama, and supposed by soiue geographers to join the peninsula of Florida to the northeast extremity of South America. It is the eastern shore of an inland sea, which may be considered as a basin with several outlets. This peculiar configuration of the land has served to support the different systems of migration, by which it has been attempted to explain the settlement of the nations of the Carib race in the islands and on the neighbouring continent. The Caribs of the continent admit that the small West India Islands were anciently inhabited by the Arowaks,* a warlike nation, the great mass of which still inhabit the insalubrious shores of Surinam and Berbice. They assert that the Arowaks, with the exception of the women, were all exterminated by Caribs, who came from the mouths of the Orinoco. In support of this tradition, they refer to the traces of analogy existing between the language of the Arowaks and that of the Carib women; but it must be recollected that the Arowaks, though the enemies of the Caribs, belonged to the same branch of people; and that the same analogy exists between the Arowak and Carib langyages, as between the Greek and the Persian, the German and the Sanserit. According to another tradition, the Caribs of the islands came from the south, not as conquerors, but because they were expelled from Guiana by the Arowaks, who originally ruled over all the neighbouring nations. Finally, a third tradition, much more general and more probable, represents the Caribs as having come from Florida, in North America. Mr. Bristock, a traveller who has collected every particular relating to these migrations from north to south, asserts, that a tribe of Confachites (Confachiqui) $\dagger$ had long waged war against the Apalachites ; that the latter, having yielded to that tribe the fertile district of Amana, called their new confederates "Caribes" (that is,
belong to history, but simply to denote that we are ignorant of the " autocthoni" having been preceded by any other people.

* Arouaques. The missionary Quandt (Nachricht von Surinam, 1807, p. 47) calls them Arawackes.
† The province of Confachiqui, which in 1541 became subject to a woman, is celebrated by the expedition of Hernando de Soto to Florida. Among the nations of the Huron tongue, and the Attakapas, the supreme authority was also often exercised by women.
"valiant strangers") ; but that, owing to a dispute respecting their religious rites, the Confachite-Caribs were driven from Florida. They went first to the Yucayas or Lucayes Islands (to Cigateo and the neighbouring islands); thence to Ayay (Hayhay, now Santa Cruz), and to the lesser Caribbee Islands ; and lastly to the continent of South America.* It is supposed that this event took place toward the year 1100 of our æra. In the course of this long migration, the Caribs had not touched at the larger islands; the inhabitants of which however also believed that they came originally from Florida. The islanders of Cuba, Hayti, and Boriken (Porto Rico) were, according to the uniform testimony of the first conquistadores, entirely different from the Caribs; and at the period of the discovery of America, the latter had already abandoned the group of the lesser Lucayes Islands; an archipelago, in which there prevailed that variety of languages always found in lands peopled by shipwreeked men and fugitives. $\dagger$
The dominion so long exercised by the Caribs over a great part of the continent, joined to the remembrance of their ancient greatness, has inspired them with a sentiment of dignity and national superiority, which is manifest in their manners and their discourse. "We alone are a nation," say they proverbially; "the rest of mankind (oquili) are made to serve us." This contempt of the Caxibs for their enemies is so strong, that I saw a child of ten years of age foam with rage on being called a Cabre or Cavere; though he had never in his life seen an individual of that unfortunate race of people, who gave their name to the town of Cabruta (Cabritu); and who, after long resistance, were almost entirely exterminated by the Caribs. Thus we find

[^384]among half savage hordes, as in the most civilized part of Europe, those inveterate animosities which have caused the names of hostile nations to pass into their respective languages as insulting appellations.

The missionary of the village of Cari led us into several Indian huts, where extreme neatness and order prevailed. We observed with pain the torments which the Carib mothers inflict on their infants, for the purpose not only of enlarging the calf of the leg, but also of raising the flesh in alternate stripes from the ankle to the top of the thigh. Narrow ligatures, consisting of bands of leather, or of woven cotton, are fixed two or three inches apart from each other, and being tightened more and more, the muscles between the bands become swollen. The monks of the missions, though ignorant of the works or even of the name of Rousseau, attempt to oppose this ancient system of physical education: but in vain. Man, when just issued from the woods, and supposed to be so simple in his manners, is far from being tractable in his ideas of beauty and propriety. I observed, however, with surprise, that the manner in which these poor children are bound, and which seems to obstruct the circulation of the blood, does not operate injuriously on their muscular movements. There is no race of men more robust, and swifter in running, than the Caribs.

If the women labour to form the legs and thighs of their children so as to produce what painters call undulating outlines, they abstain (at least in the Llanos), from flattening the head, by compressing it between cushions and planks from the most tender age. This practice, so common heretofore in the islands and among several tribes of the Caribs of Parima and French Guiana, is not observed in the missions wh'ch we visited. The men there have foreheads rounder than tho e of the Chaymas, the Otomacs, the Macos, the Maravitans, and most of the inhabitants of the Orinoco. A systemat zer would say, that the form is such as their intellectual faculties require. We were so much the more struck by this fac ${ }^{+}$, as some of the skulls of Caribs engraved in Europe, for works on anatomy, are distinguished from all other human skulls by the extremely depressed forehead and acute facial angle. In some osteological collections, skulls supposed to be those of Caribs of the island of St. Vincent are in fact
skulls shaped by having been pressed between planks. They have belonged to Zambos (black Caribs), who are descended from Negroes and true Caribs.* The barbarous habit of tlattening the forehead is practised by several nations, $\dagger$ of people not of the same race; and it has been observed recently in North America; but nothing is more vague than the conclusion, that some degree of conformity in customs and manners proves identity of origin. On observing the spirit of order and submission which prevails in the Carib missions, the traveller can scarcely persuade himself that he is among cannibals. This American word, of somewhat doubtful signification, is probably derived from the language of Hayti, or that of Porto Rico; and it has passed into the languages of Europe, since the end of the fifteenth century, as synonymous with that of anthropophagi. "These newly discovered man-eaters, so greedy of human flesh, are called Caribes or Cannibals," $\ddagger$ says Anghiera, in the third decade of his "Oceanica," dedicated to Pope Leo X. There can be little doubt that the Caribs of the islands, when a conquering people, exercised cruelties upon the Ygneris, or ancient inhabitants of the West Indies, who were weak aud not very

[^385]86 THE TERMS " OARTB * AND "CANNTBA亡."
warlike; but we must also admit that these cruelties were exaggerated by the early travellers, who heard only the nar ratives of the old enemies of the Caribs. It is not always the vanquished solely, who are calumniated by their contemporaries; the insolence of the conquerors is punished by the catalogue of their crimes being augmented.

All the missionaries of the Carony, the Lower Orinoco, and the Llanos del Cari, whom we had an opportunity of consulting, assured us that the Caribs are perhaps the least anthropophagous nations of the New Continent. They extend this remark even to the independent hordes wha wander on the east of the Esmeralda, between the sources of the Rio Branco and the Essequibo. It may be conceived that the fury and despair with which the unhappy Caribs defended themselves against the Spaniards, when in 1504 a royal decree declared them slaves, may have contributed to acquire for them a reputation for ferocity. The first idea of attacking this nation, and depriving it of liberty and of its natural rights, originated with Christopher Columbus, who was not in all instances so humane as he is represented to have been. Subsequently the licenciado Rodrigo de Figueroa was appointed by the court, in 1520, to determine the tribes of South America, who were to be regarded as of Carib race, or as cannibals; and those who were Guatiaos, that

* I had some trouble in discovering the origin of this denomination, which has become so important from the fatal decrees of Figueroa. The Spanish historians often employ the word guatiao to designate a branch of nations. To become a guatiao of any one, seems to have signified, in the language of Hayti, to conclude a treaty of friendship. In the West India Islands, as well as in the archipelago of the South Sea, names were exchanged in token of alliance. "Juan de Esquivel (1502) se hice guatiao del cacique Cotubanama; el qual desde adelante se llamo Juan de Esquivel, porque era liga de perpetua amistad entre los Indios trocarse los nombres: y trocados quedaban guatiaos, que era tanto como confederados y hermanos en armas. Ponce de Leon se hace guatiao con el poderoso cacique Agueinaha." - Herrera, dec. i. pp. 129, 159, 181.[Juan de Esquivel (1502) became the guatiao of the cacique Cotubanama; and thenceforth the latter called himself Juan de Esquivel, for among the Indians, the exchange of names was a bond of perpetual friendship. Those who exchanged names became guatiaos, which meant the same as confederates or brethren-in-arms. Ponce de Leon became guatiao withthe powerful cacique Agueinaba.] One of the Lucayes Islands, inhabited by a mild and pacific people, was heretofore called Guatao; but we will
ib, Indians of peace, and friends of the Castilians. The ethnographic document called El Auto de Figueroa, is one of the most curious records of the barbarism of the first conquistadores. Without any attention to the analogy of languages, every nation that could be accused of having devoured a prisoner after a battle, was arbitrarily declared of Carib race. The inhabitants of Uriapari (on the peninsula of Paria) were named Caribs; the Urinacos (settled on the banks of the Lower Orinoco, or Urinucu), Guatiaos. All the tribes designated by Figueroa as Caribs were condemned to slavery ; and might at will be sold, or exterminated by war. In these sanguinary struggles, the Carib women, after the death of their husbands, defended themselves with such desperation, that, Anghiera says they were taken for tribes of Amazons. But amidst the cruelties exercised on the Caribs, it is consolatory to find, that there existed some courageous men, who raised the voice of humanity and justice. Some of the monks embraced an opinion different from that which they had at first adopted. In an age wher there could be no hope of founding public liberty on civil institutions, an attempt was at least made to defend individual liberty. "That is a most holy law (ley sanctissima)," says Gomara, in 1551, "by which our emperor has prohibited the reducing of the Indians to slavery. It is just, that men, who are all born free, should not become the slaves of one another."
During our abode in the Carib missions, we observed with surprise the facility with which young Indians of eighteen years of age, when appointed to the post of alguazil, would harangue the municipality for whole hours in succession. Their tone of voice, their gravity of deportment, the gestures which accompanied their speech, all denoted an intelligent people capable of a high degree of civilization. A Franciscan monk, who knew enough of the Carib language to preach in it occasionally, pointed out to us that the long and harmonious periods which occur in the discourses of the Indians, are never confused or obscure. Particular inflexions of the verb indicate beforehand the nature of the object, whether it be animate or inanimate, singular or plural. not insist on the etymology of this word, because the languages of the Lucayes Islands differed from those of Hayti.

Little annexed forms (suffixes) mark the gradations of sentiment; and here, as in every language formed by a free development, clearness is the result of that regulating instinct which characterises human intelligence in the various stages of barbarism and cultivation. On holidays, after the celebration of mass, all the inhabitants of the village assemble in front of the church. The young girls place at the feet of the missionary faggots of wood, bunches of plantains, and other provision of which he stands in need for his household. At the same time the governador, the alguazil, and other municipal officers, all of whom are Indians, exhort the natives to labour, proclaim the occupations of the ensuing week, reprimand the idle, and flog the untractable. Strokes of the cane are received with the same insensibility as that with which they are given. It were better if the priest did not impose these corporal punishments at the instant of quitting the altar, and if he were not, in his sacerdotal habits, the spectator of this chastisement of men and women ; bnt this abuse is inherent in the principle on which the strange government of the missions is founded. The most arbitrary civil power is combined with the authority exercised by the priest over the little community ; and, although the Caribs are not cannibals, and we would wish to see them treated with mildness and indulgence, it may be conceived that energetic measures are sometimes necessary to maintain tranquillity in this rising society.

The difficulty of fixing the Caribs to the soil is the greater, as they have been for ages in the habit of trading on the rivers. We have already described this active people, at once commercial and warlike, occupied in the traffic of slaves, and carrying merchandize from the coasts of Dutch Guiana to the basin of the Amazon. The travelling Caribs were the Bokharians of equinoctial America. The necessity of counting the objects of their little trade, and transmitting intelligence, led them to extend and improve the use of the quipos, or, as they are called in the missions, the cordoncillos con nudos (cords with knots). These quipos or knotted cords are found in Canada, in Mexico (where Boturini procured some from the Tlascaltecs), in Peru, in the plains of Guiana, in central Asia, in China, and in India. As rosaries, they have become objects of devotion in the hands of the Christians
of the East; as suampans, they have been employed in the operations of manual arithmetic by the Chinese, the Tartars, and the Russians. The independent Caribs, who inhabit, the little-known country situated between the sources of the Orinoco and those of the rivers Essequibo, Carony, and Parima, are divided into tribes; and, like the nations of the Missouri, of Chili, and of ancient Germany, form a political confederation. This system is most in accordance with the spirit of liberty prevailing amongst those warlike hordes who see no advantage in the ties of society but for common defence. The pride of the Caribs leads them to withdraw themselves from every other tribe ; even from those to whom, by their language, they have some affinity.

They claim the same separation in the missions, which seldom prosper when any attempt is made to associate them with other mixed communities, that is, with villages where every hut is inhabited by a family belonging to another nation, and speaking another language. The authority of the chiefs of the independent Caribs is hereditary in the male line only, the children of sisters being excluded from the succession. This law of succession, which is founded on a system of mistrust, denoting no great purity of manners, prevails in India; among the Ashantees (in Africa); and among several tribes of the sarages of North America.* The young chiefs, and other youths who are desirous of marrying, are subject to the most extraordinary fasts and penances, and are required to take medicines prepared by the marirris or piaches, called in the transalleghanian countries, war-physic. The Carribbee marirris are at once priests, jugglers, and physicians; they transmit to their successors their doctrine, their artifices, and the remedies they employ. The latter are accompanied by imposition of hands, and certain gestures and mysterious practices, apparently connected with the

[^386]most anciently known processes of animal magnetism. Though I had opportunities of seeing many persons who had closely observed the confederated Caribs, I could not learn whether the marirris belong to a particular caste. It is observed in North America, that, among the Shawanese, ${ }^{*}$ divided into several tribes, the priests, who preside at the sacrifices, must be (as among the Hebrews) of one particular tribe, that of the Mequachakes. Any facts that may hereafter be discovered in America respecting the remains of a sacerdotal caste appears to me calculated to excite great intes rest, on account of those priest-kings of Peru, who styled themselves "the children of the Sun;" and of those "sunkings" among the Natcher, who recall to mind the Heliader of the first eastern colony of Rhodes.

On quitting the mission of Cari, we had some difficulties to settle with our Indian muleteers. They had discovered that we had brought skeletons with us from the cavern of Ataruipe; and they were fully persuaded that the beasts of burden which carried "the bodies of their old relations" would perish on the journey. $\dagger$ Every precaution we had taken was useless; nothing escapes a Carib's penetration and keen sense of smell, and it required all the authority' of the missionary to forward our passage. We had to cross the Rio Cari in a boat, and the Rio de agua clara, by fording, or, it may almost be said, by swimming. The quicksands of the bed of this river render the passage very difficult at the season when the waters are high. The strength of the current seems surprising in so flat a country; but the rivers of the plains are precipitated, to quote a correct observation of Pliny the younger, + " less by the declivity of their course than by their abundance, and as it were by their own weight." We had two bad stations, one at Matagorda and the other at Los Riecetos, before we reached the little town of Pao. We beheld everywhere the same objects; small huts constructed of reeds, and roofed with leather; men on horseback armed with lances, guarding the herds; herds of cattle half wild, remarkable for their uniform colour, and disputing the

[^387]pasturage with horses and mules. No sheep or goats are, found on these immense plains. Sheep do not thrive well in equinoctial America, except on table-lands above a thousand toises high, where their fleece is long, and sometimes very fine. In the burning climate of the plains, where the wolves give place to jaguars, these small ruminating animals, destitute of means of defence, and slow in their movements, cannot be preserved in any considerable numbers.

We arrived on the 15th of July at the Fundacion, or Villa, del Pao, founded in 1744, and situated very favourably for a commercial station between Nueva Barcelona and Angostura. Its real name is El Concepcion del Pao. Alcedo, La Cruz, Olmedilla, and many other geographers, have mistaken the situation of this small town of the Llanos of Barcelona, confounding it either with San Juan Bauptisto del Pao of the Llanos of Caracas, or with El Valle del Pao de Zarate. Though the weather was cloudy, I succeeded in obtaining some heights of a Centauri, serving to determine the latitude of the place; which is $8^{\circ} 37^{\prime} 57^{\prime \prime}$. Some altitudes of the sun gave me $67^{\circ} 8^{\prime} 12^{\prime \prime}$ for the longitude, supposing Angostura to be $66^{\circ} 15^{\prime} 21^{\prime \prime}$. The astronomical determinations of Calabozo and Concepcion del Pao are very important to the geography of this country, where, in the midst of savannabs, fixed points are altogether wanting. Some fruit-trees grow in the vicinity of Pao : they are rarely seen in the Llanos. We even found some cocoa-trees, which appeared very vigorous, notwithstanding the great distance of the sea. I was the more struck with this fact, because doubts have recently been started respecting the veracity of travellers, who assert that they have seen the cocoa-tree, which is a palm of the shore, at Timbuctoo, in the centre of Africa. We several times saw cocoa-trees amid the cultivated spots on the banks of the Rio Magdalena, more than a hundred leagues from the coast.
Five days, which to us appeared very tedious, brought us from Villa del Pao to the port of Nueva Barcelona. As we advanced, the sky became more serene, the soil more dusty, and the atmosphere more hot. The heat from which we suffered is not entirely owing to the temperature of the air, but is produced by the fine sand mingled with it; this sand
strikes against the face of the traveller, as it does against the ball of the thermometer. I never observed the mercury rise in America, amid a wind of sand, above $45.8^{\circ}$ cent. Captain Lyon, with whom I had the pleasure of conversing on his return from Mourzouk, appeared to me also inclined to think, that the temperature of fifty-two degrees, so often felt in Fezzan, is produced in great part by the grains of quartz suspended in the atmosphere. Between Pao and the village of Santa Cruz de Cachipo, founded in 1749, and inhabited by five hundred Caribs, we passed the western elongation of the little table-land, known by the name of Mesa de Amana. This table-land forms a point of partition between the Orinoco, the Guarapiche, and the coast of New Andalusia. Its height is so inconsiderable, that it would scarcely be an obstacle to the establishment of inland navigation in this part of the Llanos. The Rio Mano however, which flows into the Orinoco above the confluence of the Carony, and which D'Anville (I know not on what authority) has marked in the first edition of his great map as issuing from the lake of Valencia, and receiving the waters of the Guayra, could never have served as a natural canal between two basins of rivers. No bifurcation of this kind exists in the Llano, A great number of Carib Indians, who now inhabit the missions of Piritu, were formerly on the north and east of the table-land of Amana, between Maturin, the mouth of the Rio Arco, and the Guarapiche. The incursions of Don Joseph Careno, one of the most enterprising governors of the province of Cumana, occasioned a general migration of independent Caribs toward the banks of the Lower Orinoco in 1720 .

The whole of this vast plain consists of secondary formations, which to the southward rest immediately on the granitic mountains of the Orinoco. On the north-west they are separated by a narrow band of transition-rocks from the primitive mountains of the shore of Caracas. This abundance of secondary rocks, covering without interruption a space of more than seven thousand square leagues,* is a phenomenon the more remarkable in that region of the

[^388]globe, because in the whole of the Sierra da la Parima, between the right bank of the Orinoco and the Rio Negro, there is, as in Scandinavia, a total absence of secondary formations. The red sandstone, containing some vestiges of fossil wood (of the family of monocotyledons), is seen everywhere in the plains of Calabozo: farther east it is overlaid by calcareous and gypseous rocks, which conceal it from the research of the geologist. The marly gypsum, of which we collected specimens near the Carib mission of Cachipo, appeared to me to belong to the same tormation as the gypsum of Ortiz. To class it according to the type of European formations, I would range it among the gypsums, often muriatiterous, that cover the Alpine limestone or zechstein. Farther north, in the direction of the mission of San Josef de Curataquiche, M. Bonpland picked up in the plain some fine pieces of riband jasper, or Egyptian pebbles. We did not see them in their native place enchased in the rock, and cannot determine whether they belong to a very recent conglomerate, or to that limestone which we saw at the Morro of Nueva Barcelona, and which is not transition limestone, though it contains beds of schistose jasper (kieselschiefer).
We rested on the night of the 16th of July in the Indian village of Santa Cruz de Cachipo. This mission, founded in 1749 by several Carib families, who inhabited the inundated and unhealthy banks of the Lagunetas de Auache, opposite the confluence of the Zir Puruay with the Orinoco. We lodged at the house of the missionary, Fray Jose de las Piedras; and, on examining the registers of the parish, we saw how rapidly the prosperity of the community has been advanced by his zeal and intelligence. Since we had reached the middle of the plains, the heat had increased to such a degree, that we should have preferred travelling no more during the day ; but we were without arms, and the Llanos were then infested by large numbers of robbers, who attacked and murdered the whites who fell into their hands. Nothing can be worse than the administration of justice in these colonies. We every where tound the prisons filled with malefactors, on whom sentence is not passed till after the lapse of seven or eight years. Nearly a third of the prisoners succeed in making their escape; and the unpeo-
pled plains, filled with herds, furnish them with booby. They commit their depredations on horseback, in the manner of the Bedouins. The insalubrity of the prisons would be attended with fatal results, but that these receptacles are cleared from time to time by the flight of the prisoners. It also frequently happens that sentences of death, tardily pronounced by the Audiencia of Caracas, cannot be executed for want of a hangman. In these cases the barbarous custom is observed of pardoning one criminal on condition of his hanging the others. Our guides related to us, that, a short time before our arrival on the coast of Cumana, a Zambo, known for the great ferocity of his manners, determined to screen himself from punishment by turning executioner. The preparations for the execution however, shook his resolution; he felt a horror of himself, and preferring death to the disgrace of thus saving his life, he called again for his irons, which had been struck off. He did not long remain in prison, and he underwent his sentence through the baseness of one of his accomplices. This awakening of a sentiment of honour in the soul of a murderer is a psychologic phenomenon worthy of reflection. The man who had so often shed the blood of travellers in the plains, recoiled at the idea of becoming the passive instrument of justice, in inflicting upon others a punishment which he felt that he himself deserved.

If, even in the peaceful times when M. Bonpland and myself had the good fortune to travel through North and South America, the Llanos were the refuge of malefactors, who had committed crimes in the missions of the Orinoco, or who had escaped from the prisons on the coast, how much worse must that state of things have been rendered by discord, during the continuance of that sanguinary struggle which has terminated in conferring freedom and independence on those vast regions! Our European wastes and heaths are but a feeble image of the savannahs of the New Continent, which, for the space of eight or ten thousand square leagues are smooth as the surface of the sea. The immensity of their extent insures impunity to robbers, who conceal themselves more effectually in the savannahs than in our mountains and forests; and it is easy to conceive, that even a European police would not be very ef-
feetive in regions where there are travellers and no roads, herds and no herdsmen, and farms so solitary, that notwithstanding the powerful action of the mirage, a journey of several days may be made without seeing one appear within the horizon.
Whilat traversing the Llanos of Caracas, New Barcelona, and Cumana, which succeed each other from west to east, from the snowy mountains of Merida to the Delta of the Orinoco, we feel anxious to know whether these vast tracts of land are destined by nature to serve eternally for pasture, or whether they will at some future time be subject to the plough and the spade. This question is the more important, as the Llanos, situated at the two extremities of Bouth America, are obstacles to the political union of the provinces they separate. They prevent the agriculture of the coast of Venezuela from extending towards Guiana, and they impede that of Potosi from advancing in the direction of the mouth of the Rio de la Plata. The intermediate Llanos preserve, together with pastoral life, somewhat of a rude and wild character, which separates and keeps them remote from the civilization of countries anciently cultivated. Thus it has happened that in the war of independence, they have been the scene of struggle between the hostile parties ; and that the inhabitants of Calabozo have almost seen the fate of the confederate provinces of Venezuela and Cundinamarca decided before their walls. In assigning limits to the new states, and to their subdivisions, it is to be hoped there may not be cause hereafter to repent having lost sight of the importance of the Llanos, and the influence they may have on the disunion of communities which important common interests should bring together. These plains would serve as natural boundaries like the seas, or the virgin forests of the tropics, were it not that armies can cross them with greater facility, as their innumerable troops of horses and mules, and herds of oxen, furnish every means of conveyance and subsistence.

What we have seen of the power of man struggling against the force of nature in Gaul, in Germany, and recently (but still beyond the tropics), in the United States, scarcely affords any just measure of what we may expect from the progress of civilization in the torrid zone. Forests
disappear but very slowly by fire and the axe, when the trunks of trees are from eight to ten feet in diameter; when in falling they rest one upon another, and the wood, moistened by almost continual rains, is excessively hard. The planters who inhabit the Llanos or Pampas, do not generally admit the possibility of subjecting the soil to cultivation; it is a problem not yet solved. Most of the savannahs of Venezuela have not the same advantage as those of North America. The'latter are traversed longitudinally by three great rivers, the Missouri, the Arkansas, and the Red River of Nachitoches; the savannahs of Araura, Calabozo, and Pao, are crossed in a transverse direction only by the tributary streams of the Orinoco, the most westerly of which (the Cari, the Pao, the Acaru, and the Manapire) have very little water in the season of drought. These streams scarcely flow at all toward the north; so that in the centre of the Llanos, there remain vast tracts of land called bancos and mesas* frightfully parched. The eastern parts, fertilized by the Portuguesa, the Masparro, and the Orivante, and by the tributary streams of those three rivers, are most susceptible of cultivation. The soil is sand mixed with clay, covering a bed of quartz pebbles. The vegetable mould, the principal source of the nutrition of plants, is everywhere extremely thin. It is scarcely augmented by the fall of the leaves, which, in the forests of the torrid zone, is less periodically regular than in temperate climates. During thousands of years the Llanos have been destitute of trees and brushwood; a few scattered palms in the savannah add little to that hydruret of carbon, that extractive matter, which, according to the experiments of Saussure, Davy, and Braconnot, gives fertility to the soil. The social plants, which almost exclusively predominate in the steppes, are monocotyledons; and it is known how much grasses impoverish the soil into which their fibrous roots penetrate. This action of the killingias, paspalums, and cenchri, which form the turf, is everywhere the same; but where the rock is ready to pierce the earth, this varies according as it rests

[^389]on red sandstone, or on compact limestone and gypsum ; it varies according as periodical inundations accumulate mud on the lower grounds, or as the shock of the waters carries away from the small elevations the little soil that has covered them. Many solitary cultivated spots already exist in the midst of the pastures, where running water, and tufts of the mauritia palm, have been found. These farms, sown with maize, and planted with cassava, will multiply considerably if trees and shrubs be augmented.
The aridity and excessive heat of the mesas do not depend solely on the nature of their surface, and the local reverberation of the soil ; their climate is modified by the adjacent regions ; by the whole of the Llano of which they form a part. In the deserts of Africa, or Arabia, in the Llanos of South America, in the vast heaths extending from the extremity of Jutland to the mouth of the Scheldt, the stability of the limits of the desert, the savannahs, and the downs, depends chiefly on their immense extent, and the nakedness these plains have acquired from some revolution destructive of the ancient vegetation of our planet. By their extent, their continuity, and their mass, they oppose the inroads of cultivation, and preserve, like inland gulfs, the stability of their boundaries. I will not enter upon the great question, whether in the Sahara, that Mediterranean of moving sands, the germs of organic life are increased in our days. In proportion as our geographical knowledge has extended, we have discovered in the eastern part of the desert islets of verdure, oases covered with date-trees, crowd together in more numerous archipelagos, and open their ports to the caravans; but we are ignorant whether the form of the oases have not remained constantly the same since the time of Herodotus. Our annals are too incomplete to enable us to follow Nature in her slow and gradual progress. From these spaces entirely bare, whence some violent catastrophe has swept amay the regetable covering and the mould; from those deserts of Syria and Africa, which, by their petrified wood, attest the changes they have undergone; let us turn to the grass-covered Llanos and to the consideration of phenomena that come nearer the circle of our daily observations. Respecting the possibility of a more general cultivation of the steppes of America, the colonists, settled there, concur in the

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opinions I have deduced from the climatic action of these steppes considered as surfaces, or continuous masses. They have observed that downs enclosed within cultivated and wooded land sooner yield to the labours of the husbandman than soils alike circumscribed, but forming part of a vast surface of the same nature. This observation is extremely just, whether in reference to soil covered with heath, as in the north of Europe ; with cistuses, mastic-trees, or palmettos, as in Spain ; or with cactuses, argemones, or brathys, as in equinoctial America. The more space the association occupies, the more resistance do the social plants oppose to the labourer. With this general cause others are combined in the Llanos of Venezuela; viz. the action of the small grasses which impoverish the soil; the total absence of trees and brushwood; the sandy winds, the heat of which is increased by contact with a surface absorbing the rays of the sun during twelve hours, and unshaded, except by the stalks of the aristides, chanchuses, and paspalums. The progress observable on the vegetation of large trees, and the cultivation of dicotyledonous plants in the vicinity of towns, (for instance around Calabozo and Pao) prove what may be gained upon the Llano, by attacking it in small portions, enclosing it by degrees, and dividing it by coppices and canals of irrigation. Possibly the influence of the winds, which render the soil sterile, might be diminished by sowing on a large scale, for example, over fifteen or twenty acres, the seeds of the psidium, the croton, the cassia, or the tamarind, which prefer dry, open spots. I am far from believing that the savannahs will ever disappear entirely; or that the Llanos, so useful for pasturage and the trade in cattle, will ever be cultivated like the vallies of Aragua or other parts near the coast of Caracas and Cumana: but I am persuaded, that in the lapse of ages a considerable portion of these plains, under a government favourable to industry, will lose the wild aspect which has characterized them since the first conquest by Europeans.

After three days' journey, we began to perceive the chain of the mountains of Cumana, which separates the Llanos, or, as they are often called here, "the great sea of verdure,"* from the coast of the Caribbean Sea. If the Bergantin be

* "Los Llanos son como un mar de yerbas"-" The Llanos are like a vast sea of grass'-is an observation often repeated in these regions.
more than eight hundred toises high, it may be seen supposing ouly an ordinary refraction of one fourteenth of the arch, at the distance of twenty-seven nautical leagues; but the state of the atmosphere long concealed from us the majestic view of this curtain of mountains. It appeared at first like a fog-bank, whioh hid the stars near the pole at ther rising and setting; gradually this body of vapour seemed to augment and condense, to assume a bluish tint, and become bounded by sinuous and fixed outlines. The same effects which the mariner observes on approaching a new land present themselves to the traveller on the borders of the Llano. The horizon began to enlarge in some part, and the vault of heaven seemed no longer to rest at an equal distance on the grass-covered soil. A llanero, or inhabitant of the Llanos, is happy only when, as expressed in the simple phraseology of the country, "he can see everywhere well around him." What appears to European eyes a covered country, slightly undulated by a few scattered hills, is to him a rugged region bristled with mountains. After having passed several months in the thick forests of the Orinoco, in places where one is accustomed, when at any distance from the river, to see the stars only in the zenith, as through the mouth of a well, a journey in the Llanos is peculiarly agreeable and attractive. The traveller experiences new sensations; and, like the Llanero, he enjoys the happiness " of seeing well around him." But this enjoyment, as we ourselves experienced, is not of long duration. There is doubtless something solemn and imposing in the aspect of a boundless horizon, whether viewed from the summits of the Andes or the highest Alps, amid the expanse of the ocean, or in the vast plains of Venezuela and Tucuman. Infinity of space, as poets in every language say, is reflected within ourselves; it is associated with ideas of a superior order; it elevates the mind, which delights in the calm of solitary meditation. It is true, also, that every view of unbounded space bears a peculiar character. The prospect surveyed from a solitary peak, varies according as the clouds reposing on the plain extend in layers, are couglomerated in groups, or present to the astonished eye, through broad openings, the habitations of man, the labour of agriculture, or the verdant tint of the aërial ocean: An immense sheet of water, animated by a thousand various H 2
beings even to its utmost depths, changing perpetually in colour and aspect, moveable at its surface like the element that agitates it, all charm the imagination during long voyages by sea; but the dusty and creviced Llano, throughout a great part of the year, has a depressing influence on the mind, by its unchanging monotony. When, after eight or ten days' journey, the traveller becomes accustomed to the mirage and the brilliant verdure of a few tufts of mauritia* scattered from league to league, he feels the want of more varied impressions. He loves again to behold the great tropical trees, the wild rush of torrents, or hills and valleys cultivated by the hand of the labourer. If the deserts of Africa, and of the Llanos or savannahs of the New Continent filled a still greater space than they actually occupy, nature would be deprived of many of the beautiful products peculiar to the torrid zone. $\dagger$ The heaths of the north, the steppes of the Volga and the Don, are scarcely poorer in species of plants and animals than are the twenty-eight thousand square leagues of savannahs extending in a semicircle from north-east to south-west, from the mouths of the Orinoco to the banks of the Caqueta and the Putumayo, beneath the finest sky in the world, and in the land of plantains and bread-fruit trees. The influence of the equinoctial climate, everywhere else so vivifying, is not felt in places where the great associations of gramina almost exclude every other plant. Judging from the aspect of the soil, we might have believed ourselves to be in the temperate zone, and even still farther northward, but that a few scattered palms, and at nightfall the fine constellations of the southern sky (the Centaur, Canopus, and the innumerable nebulæ with which the Ship is resplendent), reminded us that we were only eight degrees distant from the equator.
$\AA$ A phenomenon which fixed the attention of De Luc, and

[^390]which in these latter years has furnished a subject of speculation to geologists, occupied us much during our journey across the Llanos. I allude not to those blocks of primitive rock which occur, as in the Jura, on the slope of limestone mountains, but to those enormous blocks of granite and syenite, which, in limits very distinctly marked by nature, are found scattered on the north of Holland, Germany, and the countries of the Baltic. It seems to be now proved, that, distributed as in radii, they came, at the time of the ancient
2 revolutions of our globe, from the Scandinavian peninsula southward; and that they did not primitively belong to the granitic chains of the Harz and Erzgeberg, which they approach, without, however, reaching their foot.* I was surprised at not seeing one of these blocks in the Llanos of Venezuela, though these immense plains are bounded on the south by the Sierra Parima, a group of mountains entirely granitic, and exhibiting in its denticulated and often columnar peaks traces of the most violent destruction. Northward, the granitic chain of the Silla de Caracas and Porto Cabello are separated from the Llanos by a screen of mountains, that are schistose between Villa de Cura and Parapara, and calcareous between the Bergantin and Caripe. I was no less struck by this absence of blocks on the banks of the Amazon. La Condamine affirms that from the Pongo de Manseriche to the Strait of Pauxis not the smallest stone is to be found. Now the basin of the Rio Negro and of the Amazon is also a Llano, a plain like those of Venezuela and Buenos Ayres. The difference consists only in the state of vegetation. The tro Llanos situated at the northern and southern extremities of South America are covered with gramina; they are treeless savannahs; but the intermediate Llano, that of the Amazon, exposed to almost continual equatorial rains, is a thick forest. I do not remember having heard that the Pampas of Buenos Ayres, or the savannahs of the Missouri $\dagger$ and New Mexico, contain granitic blocks. The absence of this phenomenon appears general in the New World, as it probably also is in Sahara, in Africa; for we must not confound the rocky masses that pierce the soil in the midst of

[^391]the desert, and of which travellers often make mention, with mere scattered fragments. These facts seem to prove that the blocks of Scandinavian granite, which cover the sandy countries on the south of the Baltic, and those of Westphalia and Holland, must be traced to some local revolution. The ancient conglomerate (red sandstone) which covers a great part of the Llanos of Venezuela and of the basin of the Amazon, contains no duubt fragments of the same primitive rocks which constitute the neighbouring mountains; but the convulsions, of which these mountains exhibit evident marks, do not appear to have been attended with circumstances favourable to the removal of great blocks. This geognostic phenomenon was to me the more unexpected, since there exists, nowhere in the world, so smooth a plain entirely granitic. Before my departure from Europe, I had observed with surprise that there were no primitive blocks in Lombardy, and in the great plain of Bavaria, which appears to be the botlom of an ancient lake, and which is situated two hundred and fifty toises above the level of the ocean. It is bounded on the north by the granites of the Upper Palatinate; and on the south by Alpine limestone, transitionthonschiefer, and the mica-slates of the Tyrol.

We arrived, on the 23rd of July, at the town of Nueva Barcelona, less fatigued by the heat of the Llanos, to which we had been long accustomed, than annoyed by the winds of sand, which occasion painful chaps in the skin. Seven months previously, in going from Cumana to Caracas, we had rested a few hours at the Morro de Barcelona, a fortified rock, which, near the village of Pozuelos, is joined to the continent only by a neck of land. We were received with the kindest hospitality in the house of Don Pedro Lavié, a wealthy merchant of French extraction. This gentleman, who was accused of having given refuge to the unfortunate España, when a fugitive on these coasts in 1796, was arrested by order of the Audiencia, and conveyed as a prisoner to Caracas. The friendship of the governor of Cumana, and the remembrance of the services he had rendered to the rising commerce of those countries, contributed to procure his liberty. We had endeavoured to alleviate his captivity by visiting him in prison; and we had now the satisfaction of finding him in the midst of his fanily. Illness under which he was
suffering had been aggravated by confinement; and he sank into the grave without seeing the dawn of those days of independence, which his friend Don Joseph España had predicted on the scaffold prior to his execution. "I die," said that man, who was formed for the accomplishment of grand projects, "I die an ignominious death; but my fellow citizens will soon piously collect my ashes, and my name will reappear with glory." These remarkable words were uttered in the public square of Caracas, on the 8th of May, 1799.

In 1790, Nueva Barcelona contained scarcely ten thousand inhabitants, and in 1800, its population was more than sixteen thousand. The town was founded in 1637 by a Catalonian conquistador, named Juan Urpin. A fruitless attempt was then made, to give the whole province the name of New Catalonia. As our maps often mark two towns, Barcelona and Cumanagoto, instead of one, and as the two names are considered as synonymous, it may be well to explain the cause of this error. Anciently, at the mouth of the Rio Neveri, there was an Indian town, built in 1588 by Lucas Faxardo, and named San Cristoral de los Cumanagotos. This town was peopled solely by natives who came from the saltworks of Apaicuare. In 1637, Urpin founded, two leagues farther inland, the Spanish town of Nueva Barcelona, which he peopled with some of the inhabitants of Cumanagoto, together with some Catalonians. For thirty-four years, disputes were incessantly arising between the two neighbouring communities, till in 1671, the governor Angulo succeeded inpersuading them to establish themselves on a third spot, where tho town of Barcelona now stands. According to my observations, it is situated in lat. $10^{\circ} 6^{\prime} 52^{\prime \prime}$.* The ancient town of Cumanagoto is celebrated in the country for a miraculous image of the Virgin, $\dagger$ which the Indians say was found in the hollow trunk of an old tutumo, or calabash-tree (Crescentia cujete). This image was carried in procession to Nueva Barcelona;

[^392]but whenever the clergy were dissatisfied with the inhabitants of the new city, the Virgin fled at night, and returned to the trunk of the tree at the mouth of the river. This miracle did not cease, till a fine convent (the college of the Propaganda) was built, to receive the Franciscans. In a similar case, the Bishop of Caracas caused the image of Our Lady de los Valencianos to be placed in the archives of the bishopric, where she remained thirty years under seal.

The climate of Barcelona is not so hot as that of Cumana, but it is extremely damp, and somewhat unhealthy in the rainy season. M. Bonpland had borne very well the irksome journey across the Llanos; and had recovered his strength and activity. With respect to myself, I suffered more at Barcelona than I did at Angostura, immediately after our passage on the rivers. One of those extraordinary tropical rains, during which, at sunset, drops of enormous size fall at great distances from one another, caused me to experience sensations which seemed to threaten an attack of typhus, a disease then prevalent on that coast. We remained nearly a month at Barcelona, where we found our friend Fray Juan Gonzales, of whom I have often spoken, and who had traversed the Upper Orinoco before us. He expressed regret that we had not been able to prolong our visit to that unknown country; and he examined our plants and animals with that interest which must be felt by even the most uninformed man for the productions of a region he has long since visited. Fray Juan had resolved to go to Europe, and to accompany us as far as the island of Cuba. We were together for the space of seven months, and his society was most agreeable: he was cheerful, intelligent, and obliging. How little did we anticipate the sad fate that awaited him. He took charge of a part of our collections; and a friend of his own contided to his care a child, who was to be conveyed to Spain for its education. Alas! the collection, the child, and the young ecclesiastic, were all buried in the waves.

South-east of Nueva Barcelona, at the distance of two leagues, there rises a lofty chain of mountains, abutting on the Cerro del Bergantin, which is visible at Cumana. This spot is known by the name of "the hot waters," (aguas calientes). When I felt my health sufficiently restored, we
made an excursion thither on a cool and misty morning. The waters, which are loaded with sulphuretted hydrogen, issue from a quartzose sandstone, lying on compact limestone, the same as that we had examined at the Morro. We again found in this limestone intercalated beds of black hornstein, passing into kieselschiefer. It is not, however, a transition rock; by its position, its division into small strata, its whiteness, and its dull and conchoidal fractures, (with very flattenned cavities), it rather approximates to the limestone of Jura. The real kieselschiefer and Lydianstone, have not been observed hitherto except in the transi-tion-slates and limestones. Is the sandstone, whence the springs of the Bergantin issue, of the same formation as the sandstone of the Impossible and the Tumiriquiri? The temperature of the thermal waters is only $43 \cdot 2^{\circ}$ cent. (the atmosphere being $27^{\circ}$ ). They flow first to the distance of forty toises over the rocky surface of the ground ; then they rush down into a natural cavern; and finally they pierce through the limestone, to issue out at the foot of the mountain, on the left bank of the little river Narigual. The springs, while in contact with the oxygen of the atmosphere, deposit a good deal of sulphur. I did not collect, as I had done at Mariara, the bubbles of air that rise in jets from these thermal waters. They no doubt contain a large quantity of nitrogen; because the sulphuretted hydrogen decomposes the mixture of oxygen and nitrogen dissolved in the spring. The sulphurous waters of San Juan, which issue from calcareous rock, like those of the Bergantin, have also a low temperature, ( $31.3^{\circ}$ ); while in the same region, the temperature of the sulphurous waters of Mariara and Las Trincheras (near Porto Cabello), which gush immediately from gneiss-granite, is $58.9^{\circ}$ the former, and $90.4^{\circ}$ the latter. It would seem as if the heat which these springs acquire in the interior of the globe, diminishes in proportion as they pass from primitive to secondary superposed rocks.

Our excursion to the Aguas Calientes of Bergantin ended with a vexatious accident. Our host had lent us one of his finest saddle-horses. We were warned at the same time not to ford the little river of Narigual. We passed over a sort of bridge, or rather some trunks of trees laid
closely together, and we made our horses swim, holding their bridles. The horse I had ridden suddenly disappeared, after struggling for some time under water: all our endeavours to discover the cause of this accident were fruitless. Our guides conjectured, that the animal's legs had been seized by the caymans, which are very numerous in those parts. My perplexity was extreme: delicacy, and the affluent circumstances of my host, forbade me to think of repairing his loss; and M. Lavie, more considerate of our situation, than sensible of his own misfortune, endeavoured to tranquillize us by exaggerating the facility with which fine horses were procurable from the neighbouring savannabs.

The crocodiles of the Rio Neveri are large and numerous, especially near the mouth of the river; but in general they are less fierce than the crocodiles of the Orinoco. These animals manifest in America the same contrasts of ferocity as in Egypt and Nubia : this fact is obvious when we compare with attention the narratives of Burckhardt and Belzoni. The state of cultivation in different countries, and the amount of population in the proximity of rivers, modify the habits of these large saurians : they are timid when on dry ground, and they flee from man, even in the water, when they are not in want of food and when they perceive any danger in attacking. The Indians of Nueva Barcelona convey wood to market in a singular manner. Large logs of zygophyllum and casalpinia* are thrown into the river, and carried down by the stream, while the owners of the wood swim here and there, to float the pieces that are stopped by the windings of the banks. This could not be done in the greater part of those American rivers in which crocodiles are found. The town of Barcelona has not, like Cumana, an Indian suburb; and the only natives who are seen there are inhabitants of the neighbouring missions, or of huts scattered in the plain. Neither the one nor the other are of Carib race, but a mixture of the Cumanagotos, Palenkas, and Piritus; short, stunted, indolent, and addicted to drinking. Fermented cassava is here

[^393]the favourite beverage ; the wine of the palm-tree, which is used on the Orinaco, being almost unknown on the coast. It is curious to observe, that men in different zones, to satisfy the passion of inebriety, employ not only all the families of monocotyledonous and dicotyledonous plants, but even the poisonous Agaric (Amanita muscaria) of which, with disgusting economy, the Coriacs have learnt to drink the same juice several times during five successive days.*

The packet boats (correos) from Corunna bound for the Havamnah and Mexico had been due three months; and it was believed they had been taken by the English cruisers stationed on this coast. Anxious to reach Cumana, in order to avail ourselves of the first opportunity that might offer for our passage to Vera Cruz, we hired an open boat called a lancha, a sort of craft employed habitually in the latitudes east of Cape Codera, where the sea is scarcely ever rough. Our lancha, which was laden with cacao, carried on a contraband trade with the island of Trinidad. For this reason the owner imagined we had nothing to fear from the enemy's vessels, which then blockaded all the Spanish ports. We embarked our collection of plants, our instruments, and our monkeys; and, the weather being delightful, we hoped to make a very short passage from the mouth of the Rio Neveri to Cumana: but we had searcely reached the narrow channel between the continent and the rocky isles of Borracha and the Chimanas, when to our great surprise we came in sight of an armed boat, which, whilst hailing us from a great distance, fired some musket-shot at us. The boat belonged to a privateer of Halifax; and I recognized among the sailors a Prussian, a native of Memel. I had found no opportunity, since my arrival in America, of expressing myself in my native language, and I could have wished to have spoken it on a less unpleasant occasion. Our protesta-

[^394]tions were without effect: we were carried on board the privateer, and the captain, affecting not to recognize the passports delivered by the governor of Trinidad for the illicit trade, declared us to be a lawful prize. Being a little in the habit of speaking English, I entered into conversation with the captain, begging not to be taken to Nova Scotia, but to be put on shore on the neighbouring coast. While I endeavoured, in the cabin, to defend my own rights, and those of the owner of the lancha, I heard a noise on deck. Something was whispered to the captain, who left us in consternation. Happily for us, an English sloop of war, the Hawk, was cruising in those parts, and had signalled the captain to bring to ; but the signal not being promptly answered, a gun was fired from the sloop, and a midshipman sent on board our vessel. He was a polite young man, and gave me hopes, that the lancha, which was laden with cacao, would be given up, and that on the following day we might pursue our voyage. In the meantime he invited me to accompany him on board the sloop, assuring me that his commander, Captain Garnier. would furnish me with better accomodation for the night, than I should find in the vessel from Halifax.

I accepted these obliging offers, and was received with the utmost kindness by Captain Garnier, who had made the voyage to the north-west coast of America with Vancouver, and who appeared to be highly interested in all I related to him respecting the great cataracts of Atures and Maypures, the bifurcation of the Orinoco, and its communication with the Amazon. He introduced to me several of his officers, who had been with Lord Macartney in China. I had not, during the space of a year, enjoyed the society of so many well-informed persons. They had learned from the English newspapers the object of my enterprise. I was treated with great confidence, and the commander gave me up his orn state-room. They gave me at parting the astronomical Ephemerides for those years which I had not been able to procure in France or Spain. I am indebted to Captain Garnier for the observations I was enabled to make on the satellites beyond the equator, and I feel it a duty to record here the gratitude I feel for his kindness. Coming from the forests of Cassiquiare, and having been confined during whole
months to the narrow circle of missionary life, we felt a high gratification at meeting for the first time with men who had sailed round the world, and whose ideas were enlarged by so extensire and varied a course. I quitted the English vessel with impressions which are not yet effaced from my remembrance, and which rendered me more than ever satisfied with the career on which I had entered.
We continued our passage on the following day; and were surprised at the depth of the channels between the Caracas Islands, where the sloop worked her way through them almost touching the rocks. How much do these calcareous islets, of which the form and direction call to mind the great catastrophe that separated from them the mainland, differ in aspect from the volcanic archipelago on the north of Lanzerote, where the hills of basalt seem to have been heaved up from the bottom of the sea! Numbers of pelicans and of flamingos, which fished in the nooks, or harassed the pelicans in order to seize their prey, indicated our approach to the coast of Cumana. It is curious to observe at sunrise how the sea-birds suddenly appear and animate the scene, reminding us, in the most solitary regions, of the activity of our cities at the dawn of day. At nine in the morning we reached the gulf of Cariaco, which serves as a roadstead to the town of Cumana. The hill, crowned by the castle of San Antonio, stood out, prominent from its whiteness, on the dark curtain of the inland mountains. We gazed with interest on the shore, where we first gathered plants in America, and where, some months later, M. Bonpland had been in such danger. Among the cactuses, that rise in columns twenty feet high, appear the Indian huts of the Guaykeries. Every part of the landscape was familiar to us; the forest of cactus, the scattered huts and that enormous ceiba, beneath which we loved to bathe at the approach of night. Our friends at Cumana came out to meet us: men of all castes, whom our frequent herborizations had brought into contact with us, expressed the greater joy at sight of us, as a report that we had perished on the banks of the Orinoco had been current for several months. These reports had their origin either in the severe illness of M. Bonpland, or in the fact of our boat having been nearly lost in a gale above the mission of Uruana.

We hastened to visit the governor, Don Vicente Emparan, whose recommendations and constant solicitude had been so useful to us during the long journey we had just terminated. He procured for us, in the centre of the town, a house which, though perhaps too lofty in a country exposed to violent earthquakes, was extremely useful for our instruments. We enjoyed from its terraces a majestic view of the sea, of the isthmus of Araya, and the archipelago of the islands of Caracas, Picuita, and Borracha. The port of Cumana was every day more and more closely blockaded, and the rain expectation of the arrival of Spanish packets detained us two months and a half longer. We were often nearly tempted to go to the Danish islands, which enjoyed a happy neutrality; but we feared that, if we left the Spanish colonies, we might find some obstacles to our return. With the ample freedom which in a moment of favour had been granted to us, we did not consider it prudent to hazard anything that might give umbrage to the local authorities. We employed our time in completing the Flora of Cumana, geologically examining the eastern part of the peninsula of Araya, and observing many eclipses of satellites, which confirmed the longitude of the place already obtained by other means. We also made experiments on the extraordinary refractions, on evaporation, and on atmospheric electricity.

The living animals which we had brought from the Orinoco were objects of great curiosity to the inhabitants of Cumana. The capuchin of the Esmeralda (Simia chiropotes), which so much resembles man in the expression of its physiognomy; and the sleeping monkey (Simia trivirgata), which is the type of a new group; had never yet been seen on that coast. We destined them for the menagerie of the Jardin des Plantes at Paris. The arrival of a French squadron, which had failed in an attack upon Curaçao, furnished us, unexpectedly, with an excellent opportunity for seuding them to Guadaloupe; and General Jeannet, together with the commissary Bresseau, agent of the executive power at the Antilles, promised to convey them. The monkeys and birds died at Guadaloupe, but fortunately the skin of the Simia chiropotes, the only one in Europe, was sent a few years ago to the Jardin des Plantes, where the couxio (Simis
satanas), and the stentor or alouate of the steppes of Caracas (Simia ursina), had been already received. The arrival of so great a number of French military officers, and the manifestation of political and religious opinions not altogether conformable with the interests of the governments of Europe, excited singular agitation in the population of Cumana. The governor treated the French authorities with the forms of civility consistent with the friendly relations subsisting at that period between France and Spain. In the streets the coloured people crowded round the agent of the French Directory, whose dress was rich and theatrical. White men, too, with indiscreet curiosity, whenever they could make themselves understood, made enquiries concerning the degree of influence granted by the republic to the colonists in the government of Guadaloupe. The king's officers doubled their zeal in furnishing provision for the little squadron. Strangers, who boasted that they were free, appeared to these people troublesome guests ; and in a country, of which the growing prosperity depended on clandestine communication with the islands, and on a freedom of trade forced from the ministry, the European Spaniards extolled the wisdom of the old code of laws (leyes de Indias), which permitted the entrance of foreign vessels into their ports only in extreme cases of want or distress. These contrasts between the restless desires of the colonists, and the distrustful apathy of the government, throw some light on the great political events which, after long preparation, have separated Spain from her colonies.
We again passed a few agreeable days, from the third to the fifth of November, at the peninsula of Araya, situated beyond the gulf of Cariaco, opposite to Cumana.* We were informed, that the Indians carried to the town from time to time considerable quantities of native alum, found in the neighbouring mountains. The specimens shewn to us sufficiently indicated, that it was neither alunite, similar to the rock of Tolfa and Piombino, nor those capillary and silky salts of alkaline sulphate of alumina and magnesia, that line the clefts and cavities of rocks, but real

[^395]masses of native alum, with a conchoidal or imperfectly lamellar fracture. We were led to hope that we should find the mine of alum (mina de alun) in the slaty cordillera of Maniquarez, and so new a geological phenomenon was calculated to rivet our attention. The priest Juan Gonzales, and the treasurer, Don Manuel Navarete, who had been useful to us from our first arrival on this coast, accompanied us in our little excursion. We disembarked near Cape Caney, and again visited the ancient saltpit (which is converted into a lake by the irruption of the sea), the fine ruins of the castle of Araya, and the calcareous mountain of the Barigon, which, from its steepness on the western side is somewhat difficult of access. Muriatiferous clay mixed with bitumen and lenticular gypsum, and sometimes passing to a darkish brown clay, devoid of salt, is a formation widely spread through this peninsula, in the island of Margareta, and on the opposite continent, near the castle of San Antonio de Cumana. Probably the existence of this formation has contributed to produce those ruptures and rents in the ground, which strike the eye of the geologist when he stauds on one of the eminences of the peninsula of Araya. The cordillera of this peninsula, composed of micaslate and clay-slate, is separated on the north from the chain of mountains of the island of Margareta, (which are of a similar composition,) by the channel of Cubagua; and on the south it is separated from the lofty calcareous chain of the continent, by the gulf of Cariaco. The whole intermediate space appears to have been heretofore filled with muriatiferous clay; and no doubt the continual erosions of the ocean have removed this formation, and converted the plain, first into lakes, then into gulfs, and finally into navigable channels. The account of what has passed in the most modern times at the foot of the castle of Araya, the irruption of the sea into the ancient saltpit, the formation of the laguna de Chacopata, and a lake, four leagues in length, which cuts the island of Margareta nearly into two parts, afford evident proofs of these successive erosions. In the singular configuration of the coasts in the Morro of Chacopata; in the little islands of the Caribbees, the Lobos and Tunal; in the great island of Coche, and the capes of Carnero and Mangliers; there still seem to be apparent the remains of an
isthmus which, stretching from north to south, formerly joined the peninsula of Araya to the island of Margareta. In that island a neck of very low land, three thousand toises long, and less than two hundred toises broad, conceals on the northern sides the two hilly groups, known by the names of La Vega de San Juan, and the Macanao. The Laguna Grande of Margareta has a very narrow opening to the south, and small boats pass by portage over the neck of land or northern dyke. Though the waters on these shores seem at present to recede from the continent, it is nevertheless very probable, that in the lapse of ages, either by an earthquake or by a sudden rising of the ocean, the long island of Margareta will be divided into two rocky islands of a trapezoidal form.
The limestone of the Barigon, which is a part of the great formation of sandstone or calcareous breccia of Cumana, is filled with fossil shells in as perfect preservation as those of other tertiary limestones in France and Italy. We detached some blocks, containing oysters eight inches in diameter, pectens, venuses, and lithophyte polypi. I recommend to naturalists better versed in the knowledge of fossils than I then was, to examine with care this mountainous coast (which is easy of access to European vessels), in their way to Cumana, Guayra, or Curaçao. It would be curious to discover whether any of these shells, and these species of petrified zoophytes, still inhabit the sea of the West Indies, as M. Bonpland conjectured, and as is the case in the island of Timor, and perhaps in Guadaloupe.

We sailed on the 4th of November, at one o'clock in the morning, in search of the mine of native alum. I took with me the chronometer and my large Dollond telescope, intending to observe at the Laguna Chica (Small Lake), east of the village of Maniquarez, the immersion of the first satellite of Jupiter; this design, however, was not accomplished, contrary winds having prevented our arrival before daylight. The spectacle of the phosphorescence of the ocean, and the sports of the porpoises which surrounded our canoe, somewhat atoned for this disappointment. We again passed those spots where springs of petroleum gush from mica-slate at the bottom of the sea, and the smell of which is perceptible from a considerable distance. When it

[^396]is recollected that farther eastward, near Cariseo, the hot and submarine waters are sufficiently abundant to change the temperature of the gulf at its surface, we cannot doubt that the petroleum is the effect of distillation at an immense depth, issuing from those primitive rocks, beneath which lies the focus of all volcanic commotion.

The Laguna Chica is a cove surrounded by perpendicular mountains, and connected with the gulf of Cariaco only by a narrow channel twenty-five fathoms deep. It seems, like the fine port of Acapulco, to owe its existance to the effect of an earthquake. A beach shows that the sea is here receding from the land, as on the opposite coast of Cumana. The peninsula of Araya, which narrows between Cape Mero and Cape las Minas to one thousand four hundred toises, is little more than four thousand toises in breadth near the Laguna Chica, reckoning from one sea to the other. We had to cross this distance in order to find the native alum, and to reach the cape called the Punta de Chuparuparu. The road is difficult only because no path is traced; and between precipices of some depth we were obliged to step over ridges of bare rock, the strata of which are much inclined. The principal point is nearly two hundred and twenty toises high; but the mountains, as it often happens in a rocky isthmus, display very singular forms. The Paps (tetas) of Chacopata and Cariaco, midway between the Laguna Chica and the town of Cariaco, are peaks, which appear isolated when viewed from the platform of the castle of Cumana. The vegetable earth in this country is only thirty toises above sealevel. Sometimes there is no rain for the space of fifteen months; if, however, a few drops fall immediately after the flowering of the melons and gourds, they yield fruit weighing from sixty to seventy pounds, notwithstanding the apparent dryness of the air. I say apparent dryness, for my hygrometric observations prove that the atmosphere of $\mathrm{Cu}-$ mana and Araya contains nearly nine-tenths of the quantity of watery vapour necessary to its perfect saturation. It is this air, at once hot and humid, that nourishes those vegetable reservoirs, the cucurbitaceous plants, the agaves and melocactuses half-buried in the sand. When we visited the peninsula the preceding year, there was a great scarcity
of water ; the goats for want of grass died by hundreds. During our stay at the Orinoco, the order of the seasons seemed to be entirely changed. At Araya, Cochen, and even in the island of Margareta, it had rained abundantly; and those showers were remembered by the inhabitants in the same way as a fall of aërolites would be noted in the recollection of the naturalists of Europe.
The Indian who was our guide soarcely knew in what direction we should find the alum ; he was ignorant of its real position. This ignorance of localities characterises almost all the guides here, who are chosen from among the most indolent class of the people. We wandered for eight or nine hours among rocks totally bare of vegetation. The micarslate passes sometimes to clay-slate of a darkish grey. I was again struck by the extreme regularity in the direction and incimation of the strata. They run north $50^{\circ}$ east, inclining from $60^{\circ}$ to $70^{\circ}$ north-west. This is the general direction which I had observed in the gneiss-granite of Caracas and the Orinoco, in the hornblende-slates of Angostura, and even in the greater part of the secondary rocks we had just examined. The beds, over a vast extent of land, make the same angle with the meridian of the place; they present a parallelism, which may be considered as one of the great geologic laws capable of being verified by precise measures. Advancing toward Cape Chuparuparu, the veins of quartz that cross the mica-slate increase in size. We found some from one to two toises broad, full of amall fasciculated crystals of rutile titanite. We sought in vain for cyanite, which we had discovered in some blocks near Maniquarez. Farther on, the mica-slate presents not veins, but little beds of graphite or carburetted iron. They are from two to three inches thick, and have precisely the same direction and inclination as the rock. Graphite, in primitive soils, marks the first appearance of carbon on the globe,-that of carbon uncombined with hydrogen. It is anterior to the period when the surface ot the earth became covered with monocotyledonous plants. From the summit of those wild mountains there is a majestic view of the island of Margareta. Two groups of mountains already mentioned, those of Macanao, and La Vega de San Jusn, rise from the bosom of the waters. The capital of
the island, La Asuncion, the port of Pampatar, and the villages of Pueblo de la Mar, Pueblo del Norte, and San Juan, belong to the second and most easterly of these groups. The western group, the Macanao, is almost entirely uninhabited. The isthmus that divides these large masses of mica-slate was scarcely visible; its form appeared changed by the effect of the mirage, and we recognized the intermediate part through which runs the Laguna Grande, only by two small hills of a sugarloaf form, in the meridian of the Punta de Piedras. Nearer we look down on the small desert archipelago of the four Morros del Tunal, the Caribbee, and the Lobos Islands.

After much vain search we at length found, before we descended to the northern coast of the peninsula of Araya, in a ravine of very difficult access (Aroyo del Robalo,) the mineral which had been shown to us at Cumana. The mica-slate changed suddenly into carburetted and shining clay-slate. It was an ampelite; and the waters (for there are small springs in those parts, and some have recently been discovered near the village of Maniquarez) were impregnated with yellow oxide of iron, and had a styptic taste. We found the sides of the neighbouring rocks lined with capillary sulphate of alumina in effervescence; and real beds, two inches thick, full of native alum, extending as far as the eye could reach in the clay slate. The alum is greyish white, somewhat dull on the surface, and of an almost glassy lustre internally. Its fracture is not fibrous, but imperfectly conchoidal. It is slightly translucent when its fragments are thin; and has a sweetish and astringent taste, without any bitter mixture. When on the spot, I proposed to myself the question whether this alum, so pure, and filling beds in the clay-slate without leaving the smallest void, be of a formation contemporary with the rock, or whether it be of a recent, and in some sort secondary, origin, like the muriate of soda, found sometimes in small veins, where strongly concentrated springs traverse beds of gypsum or clay. In these parts nothing seems to indicate a process of formation likely to be renewed in our days. The slaty rock exhibits no open cleft; and none is found parallel with the direction of the slates. It may also be inquired, whether this aluminous slate be a transition-
formation lying on the primitive mica-slate of Araya, or whether it owe its origin merely to a change of composition and texture in the beds of mica-slate. I lean to the latter proposition; for the transition is progressive, and the clayslate (thonschiefer) and mica-slate appear to me to constitute here but one formation. The presence of cyanite, rutile-titanite, and garnets, and the absence of Lydian stone, and all fragmentary or arenaceous rocks, seem to characterise the tormation we describe as primitive. It is asserted, that even in Europe ampelite and green stone are found, though rarely, in slates anterior to transition-slate.

When, in 1785, after an earthquake, a great rocky mass was broken off in the Aroyo del Robalo, the Guaykeries of Los Serritos collected fragments of alum five or six inches in diameter, extremely pure and transparent. It was sold in my time at Cumana to the dyers and tanners, at the price ot two reals* per pound, while alum from Spain cost twelve reals. This difference of price was more the result of prejudice, and of the impediments to trade, than of the inferior quality of the alum of the country, which is fit for use without undergoing any purification. It is also found in the chain of mica-slate and clay-slate, on the north-west coast of the island of Trinidad, at Margareta, and near Cape Chuparuparu, north of the Cerro del Distiladero. $\dagger$ The Indians, who are naturally addicted to concealment, are not inclined to make known the spots whence they obtain native alum ; but it must be abundant, for I have seen very considerable quantities of it in their possession at a time.

South America at present receives its alum from Europe, as Europe in its turn received it from the natives of Asia previous to the fifteenth century. Mineralogists, before my travels, knew no substances which, without addition, calcined or not calcined, could directly yield alum (sulphate of alumina and potash), except rocks of trachytic formation,

[^397]and small veins traversing beds of lignite and bituminows wood. Both these substances, so different in their origin, contain all that constitutes alum, that is to say, alumina, sulphuric acid, and potash. The ores of Tolfa; Milo, and Nipoligo ; those of Montione, in which silica does not accompany the alumina; the siliceous breccia of Mont Doré, which contains sulphur in its cavities; the alumiferous rocks of Parad and Beregh in Hungary, which belong also to trachytic and pumice conglomerates, may no doubt be traced to the penetration of sulphurous acid vapours. They are the products of a feeble and prolonged volcanic action, as may be easily ascertained in the solfataras of Pazzuoli and the Peak of Teneriffe. The alumite of Tolfa, which, since my return to Europe, I have examined on the spot, conjointly with Gay-Lussac, has, by its oryctognostic characters and its chemical composition, a considerable affinity to compact feldspar, which constitutes the basis of so many trachytes and transition-porphyries. It is a siliciferous subsulphate of alumina and potash, a compact feldspar, with the addition of sulphuric acid completely formed in it. The waters circulating in these alumiferous rocks of volcanic origin do not, however, deposit masses of native alum, to yield which the rocks must be roasted. I know not of any deposits analogous to those I brought from Cumana; for the capillary and fibrous masses found in veins traversing beds of lignites (as on the banks of the Egra, between Saatz and Commothau in Bohemia), or efflorescing in cavities (as at Freienwalde in Brandenburg, and at Segario in Sardinia), are mpure salts, often destitute of potash, and mixed with the sulphates of ammonia and magnesia. A slow decomposition of the pyrites, which probably act as so many little galvanic piles, renders the waters alumiferous, that circulate across the bituminous lignites and carburetted clays. These waters, in contact with carbonate of lime, even give rise to the deposits of subsulphate of alumina (destitute of potash), found near Halle, and formerly believed erroneously to be pure alumina, belonging, like the porcelain earth (kaolin) of Morl, to porphyry of red sanastone. Analogous chemical actions may take place in primitive and transition slates, as well as in tertiary formations. All slates, and this fact is very important,
contain nearly five per cent. of potash, sulphuret of iron, peroxide of iron, carbon, \&c. The contact of so many moistened heterogeneous substances must necessarily lead them to a change of state and composition. The efllorescent salts that abundantly cover the aluminous slates of Robalo, shew how much these chemical effects are favoured by the high temperature of the climate; but, I repeat, in a rock where there are no crevices, no vacuities parallel to the direction and inclination of the strata, native alum, semitransparent and of conchoidal fracture, completely filling its place (its beds), must be regarded as of the same age with the rock in which it is contained. The term "contemporary formation" is here taken in the sense attached to it by geologists, in speaking of beds of quartz in clayslate, granular limestone in mica-slate, or feldspar in gneiss.

After having for a long time wandered over barren scenes, amidst rocks entirely devoid of vegetation, our eyes dwelt with pleasure on tufts of malpighia and croton, which we found in descending toward the coast. These arborescent crotons were of two new species,* very remarkable for their form, and peculiar to the peninsula of Arava. We arrived too late at the Laguna Chica, to visit another rock situated farther east, and celebrated by the name of the Laguna Grande, or the Laguna del Obispo.t We contented ourselves with admiring it from the height of the mountains that command the view; and, excepting the ports of Ferrol and Acapulco, there is perhaps none presenting a more extraordinary configuration. It is an inland gulf two miles and a half long from east to west, and one mile broad. The rocks of mica-slate that form the entrance of the port, leave a free passage only two aundred and fifty toises broad. The water is everywhere from fifteen to twenty-five fathoms deep. Probably the government of Cumana will one day take advantage of the possession of this inland gulf, and of that of Mochima, $\ddagger$ eight leagues east of the bad road of Nueva Barcelona. The family of M. Navarete were waiting for us with impatience on the

[^398]beach; and, though our boat carried a large sail, we did not arrive at Maniquarez before night.

We prolonged our stay at Cumana only a fortnight. Having lost all hope of the arrival of a packet from Corumna, we availed ourselves of an American vessel, laden at Nueva Barcelona with salt provision for the island of Cuba. We had now passed sixteen months on this coast, and in the interior of Venezuela, and on the 16th November we parted from our friends at Cumana to make the passage for the third time across the gulf of Cariaco to Nueva Barcelona. The night was cool and delicious. It was not without emotion that we beheld for the last time the disc of the moon illuminating the summit of the cocoa-trees that surround the banks of the Manzanares. The breeze was strong, and in less than six hours we anchored near the Morro of Nueva Barcelona, where the vessel which was to take us to the Havannah was ready to sail.

## CHAPTER XXVII.

Political state of the Provinces of Venezuela.-Extent of Territory.-Population.- Natural Productions.- External Trade.- Communications between the different Provinces comprising the Republic of Columbia.

Before I quit the coasts of Terra Firma, and draw the attention of the reader to the political importance of Cuba, the largest of the West India Islands, I will collect into one point of view all those facts which may lead to a just appreciation of the future relations of commercial Europe with the united Provinces of Venezuela. When, soon after my return to Germany, I published the "Essai Politique sur la Nouvelle-Espagne," I at the same time made known some of the facts I had collected in relation to the territorial riches of South America. This comparative view of the population, agriculture, and commerce of all the Spanish colonies was formed at a period when the progress of civilization was restrained by the imperfection of social institutions, the prohibitory system, and other fatal errors in the science of government. Since the time when I developed the im-
mense resources which the people of both North and South America might derive from their own position and their relations with commercial Europe and Asia, one of those great revolutions which from time to time agitate the human race, has changed the state of society in the vast regions through which I travelled. The continental part of the New World is at present in some sort divided between three nations of European origin ; one (and that the most powerful) is of Germanic race : the two others belong by their language, their literature, and their manners to Latin Europe. Those parts of the old world which advance farthest westward, the Spanish Peninsula and the British Islands, are those of which the colonies are most extensive; but four thousand leagues of coast, inhabited solely by the descendants of Spaniards and Portuguese, attest the superiority which in the fifteenth and sixteenth centuries the peninsular nations had acquired, by their maritime expeditions, over the navigators of other countries. It may be fairly asserted that their languages, which prevail from California to the Rio de la Plata, and along the back of the Cordilleras, as well as in the forests of the Amazon, are monuments of national glory that will survive every political revolution.

The inhabitants of Spanish and Portuguese America form together a population twice as numerous as the inhabitants of English race. The French, Dutch, and Danish possessions of the new continent are of small extent; but, to complete the general view of the nations which may influence the destiny of the other hemisphere, we ought not to forget the colonists of Scandinavian origin, who are endeavouring to form settlements from the peninsula of Alashka as far as California; and the free Africans of Hayti, who have verified the prediction made by the Milanese traveller Benzoni in 1545. The situation of these Africans in an island more than three times the size of Sicily, in the middle of the West Indian Mediterranean, augments their political importance.

- Every friend of humanity prays for the development of the civilization which is advancing in so calm and unexpected a manner. As yet Russian America is less like an agricultural colony than the factories established by Europeans on the coast of Africa, to the great misfortune of the natives; they contain only military posts, stations of fishermen, and

Siberian hunters. It is a curious phenomenon to find the rites of the Greek Church established in one part of America, and to see tro nations which inhabit the eastern and western extremities of Europe (the Russians and the Spaniards) thus bordering on each other on a continent on which they arrived by opposite routes; but the almost savage state of the unpeopled coasts of Ochotsk and Kamtszhatka, the want of resources furnished by the ports of Asia, and the barbarous system hitherto adopted in the Scandinavian colonies of the New World, are circumstances which will hold them long in infancy. Hence it follows, that if in the researches of political economy we are accustomed to survey masses only, we cannot but admit that the American continent is divided, properly speaking, between three great nations of English, Spanish, and Portugueso race. The first of these three nations, the Anglo-Americans, is, next to the English of Europe, that whose flag waves over the greatest extent of sea. Without any distant colonies, its commerce has acquired a growth attained in the old world by that nation alone which communicated to North America its language, its literature, its love of labour, its predilection for liberty, and a portion of its civil institutions.

The English and Portuguese colonists have peopled only the coasts which lie opposite to Europe ; the Castilians, on the contrary, in the earliest period of the conquest, crossed the chain of the Andes, and made settlements in the most western regions. There only, at Mexico, Cundinamarca, Quito, and Peru, they found traces of ancient civilization, agricultural nations, and flourishing empires. This circumstance, together with the increase of the native mountain population, the almost exclusive possession of great metallic wealth, and the commercial relations established from the beginning of the sixteenth century with the Indian archipelago, have given a peculiar character to the Spanish possessions in equinoctial America. In the East Indies, the people who fell into the hands of the English and Portuguese settlers were wandering tribes, or hunters. Far from forming a portion of the agricultural and laborious population, as on the table land of Anahuac, at Guatimala, and in Upper Peru, they generally withdrew at the approach of the whites.

The necessity of labour, the preference given to the cultivan tion of the sugar-cane, indigo, and cotton, the cupidity which often accompanies and degrades industry, gave birth to that infamous slave-trade, the consequences of which have been alike fatal to the old and the new world. Happily, in the continental part of Spanish America, the number of African slaves is so inconsiderable, that, compared with the slave population of Brazil, or with that of the southern part of the United States, it is found to be in the proportion of one to fourteen. The whole of the Spanish colonies, without excluding the islands of Cuba and Porto Rico, have not, over a surface which exceeds at least by one-fifth that of Europe, as many negroes as the single state of Virginia. The Spanish Americans, in the union of New Spain and Guatimala, present an example, unique in the torrid zone, viz., a nation of eight millions of inhahitants governed conformably with European institutions and laws, cultivating sugar, cacao, wheat, and grapes, and having scarcely a slave brought from Africa.

The population of the New Continent as yet surpasses but little that of France or Germany. It doubles in the United States in twenty-three or twenty-five years; and at Mexico, even under the government of the mother country, it doubles in forty or forty-five years. Without indulging too flattering hopes of the future, it may be admitted, that in less than a century and a half the population of America will equal that of Europe. This noble rivalry in civilization, and the arts of industry and commerce, far from impoverishing the old continent, as has often been supposed it might at the expense of the new one, will augment the wants of the consumer, the mass of productive labour, and the activity of exchange. Doubtless, in consequence of the great revolutions which human society undergoes, the public fortune, the common patrimony of civilization, is found differently divided among the nations of the old and the new world : but by degrees the equilibrium is restored; and it is a fatal, I had almost said an impious prejudice, to consider the growing prosperity of any other part of our planet as a calamity to Europe. The independence of the colonies will not contribute to isolate them from the old civilized nations, but will rather bring all more closely together. Commerce tends
to unite countries which a jealous policy has long separated. It is the nature of civilization to go forward, without any tendency to decline in the spot that gave it birth. Its progress from east to west, from Asia to Europe, proves nothing against this axiom. A clear light loses none of its brilliancy by being diffused over a wider space. Intellectual cultivation, that fertile source of national wealth, advances by degrees and extends without being displaced. Its movement is not a migration : and though it may seem to be such in the east, it is because barbarous hordes possessed themselves of Egypt, Asia Minor, and of once free Greece, the forsaken cradle of the civilization of our ancestors.

The barbarism of nations is the consequence of oppression exercised by internal despotism or foreign conquest ; and it is always accompanied by progressive impoverishment, by a diminution of the public fortune. Free and powerful institutions, adapted to the interests of all, remove these dangers; and the growing civilization of the world, the competition of labour and of trade, are not the ruin of states, whose welfare flows from a natural source. Productive and commercial Europe will profit by the new order of things in Spanish America, as it would profit from events that might put an end to barbarism in Greece, on the northern coast of Africa, and in other countries subject to Ottoman tyranny. What most menaces the prosperity of the ancient continent is the prolongation of those intestine struggles which check production, and diminish at the same time the number and wants of consumers. This struggle, begun in Spanish America six years after my departure, is drawing gradually to an end. We shall soon see both shores of the Atlantic peopled by independent nations, ruled by different forms of Government, but united by the remembrance of a common origin, uniformity of language, and the wants which civilization creates. It may be said, that the immense progress of the art of navigation has contracted the boundaries of the seas. The Atlantic already assumes the form of a narrow channel, which no more removes the New World from the commercial states of Europe, than the Mediterranean, in the infancy of navigation, removed the Greeks of Peloponnesus from those of Ionia, Sicily, and the Cyrenaic region.

I have thought it right to enter into these general considerations on the future connection of the two continents, before tracing the political sketch of the provinces of Venezuela. These provinces, governed till 1810 by a cap-tain-general residing at Caracas, are now united to the old viceroyalty of New Grenada, or Santa Fé, under the name of the Republic of Columbia. I will not anticipate the description which I shall have hereafter to give of New Grenada; but, in order to render my observations on the statistics of Venezuela more useful to those who would judge of the political importance of the country, and the advantages it may offer to the trade of Europe, even in its present unadvanced state of cultivation, I will describe the United Provinces of Venezuela in their relations with Cundinamarca, or New Grenada, and as forming part of the new state of Columbia. M. Bonpland and I passed nearly three years in the country, which now forms the territory of the republic of Columbia; sixteen months in Venezuela, and eighteen in New Grenada. We crossed the territory in its whole extent; on one hand from the mountains of Paria as far as Emeralda on the Upper Orinoco, and San Carlo del Rio Negro, situated near the frontiers of Brazil; and on the othet, from Rio Sinu and Carthagena as far as the snowy summits of Quito, the port of Guayaquil on the coast of the Pacific, and the banks of the Amazon in the province of Jaen de Bracamoros. So long a stay and an expedition of one thousand three hundred leagues in the interior of the country, of which more than six hundred and fifty were by water, have furnished me with a pretty accurate knowledge of local circumstances.

I am aware that travellers, who have recently visited America, regard its progress as far more rapid than my statistical researches seem to indicate. For the year 1913 they promise one hundred and twelve millions of inhabitants in Mexico, of which they believe that the population is doubled every twenty-two years; and during the same interval one hundred and forty millions in the United States. These uumbers, I coufsss, do not appear to me to be alarming from the motives that may cxcite fear among the disciples of Malthus. It is possible, that some time or other, two or three hundred millions of men may find subsistence in the
vast extent of the new continent between the lake of Nicaragua and lake Ontario. I admit that the United States will contain above eighty millions of inhabitants a hundred years hence, allowing a progressive change in the period of doubling from twenty-five to thirty-five and forty years; but, notwithstanding the elements of prosperity to be found in equinoctial America, I doubt whether the increase of the population in Venezuela, Spanish Guiana, New Grenada and Mexico, can be in general so rapid as in the United States. The latter, which are situated entirely in the temperate zone, destitute of high chains of mountains, embrace an immense extent of country, easy of cultivation. The hordes of Indian hunters flee both from the colonists, whom they abhor, and the methodist missionaries, who oppose their taste for indolence and a vagabond life. The more fertile land of Spanish America producesindeed on the same surface a greater amount of nutritive substances. On the table lands of the equinoctial regions, wheat doubtless yields annually from twenty to tirenty-four for one; but Cordilleras furrowed by almost inaccessible crevices, bare and arid steppes, forests that resist both the axe and fire, and an atmosphere filled with venomous insects, will long present powerful obstacles to agriculture and industry. The most active and enterprising colonists cannot, in the mountainous districts of Merida, Antioquia, and Los Pastos, in the llanos of Venezuela and Guaviare, in the forests of the Rio Magdalena, the Orinoco, and the province of Las Esmeraldas, west of Quito, extend their agricultural conquests as they have done in the woody plains westward of the Alleghanies, from the sources of the Ohio, the Tennessee, and the Alabama, as far as the banks of the Missouri and the Arkansas. Calling to mind the account of my voyage on the Orinoco, it may be easy to appreciate the obstacles which nature opposes to the efforts of man in hot and humid climates. In Mexico, large extents of soil are destitute of springs; rain seldom falls, and the want of navigable rivers impedes communication. As the ancient native population is agricultural, and had been so long before the arrival of the Spaniards, the lands most easy of access and cultivation have already their proprietors. Fertile tracts of country, at the disposal of the first occupier,
or ready to be sold in lots for the profit of the state, are much less common than Europeans imagine. Hence it follows, that the progress of colonization cannot be everywhere as free and rapid in Spanish America, as it has hitherto been in the western provinces of the United States. The population of that union is composed wholly of whites, and of negros, who, having been torn from their country, or born in the New World, have become the instruments of the industry of the whites. In Mexico, Guatemala, Quito, and Peru, on the contrary, there exist in our day more than five millions and a half of natives of copper-coloured race, whose isolated position, partly forced and partly voluntary, together with their attachment to ancient habits, and their mistrustful inflexibility of character, will long prevent their participation in the progress of the public prosperity, notwithstanding the efforts employed to disindianize them.

I dwell on the differences between the free states of temperate and equinoctial America, to show that the latter have to contend against obstacles connected with their physical and moral position ; and to remind the reader that the countries embellished with the most varied and precious productions of nature, are not always susceptible of an easy, rapid, and uniformly extended cultivation. If we consider the limits which the population may attain, as depending solely on the quantity of subsistence which the land is capable of producing, the most simple calculations would prove the preponderance of the communities established in the fine regions of the torrid zone; but political economy, or the positive science of government, is distrustful of ciphers and vain abstractions. We know, that by the multiplication of one family only, a continent previously desert may reckon in the space of eight centuries more than eight millions of inhabitants; and yet these estimates, founded on the hypothesis of a continuous doubling in twenty-five or thirty years, are contradicted by the history of every country already advanced in civilization The destinies which await the free states of Spanish America, are too glorious to require to be embellished by illusions and ehimerical calculations.

Among the thirty-four million inhabitants spread over the vast surface of continental America, in which estimate
are comprised the savage natives, we distinguish, according to the three preponderant races, sixteen millions and a half in the possessions of the Spanish Americans, ten millions in those of the Anglo-Americans, and nearly four millions in those of the Portuguese Americans. The population of these three great divisions is, at the present time, in the proportion of $4,2 \frac{1}{2}, 1$; while the extent of surface over which the population is spread, is, as the numbers $1.5,0.7,1$. The area of the United States is nearly one-fourth greater than that of Russia west of the Ural mountains; and Spanish America is in the same proportion more extensive than the whole of Europe. The United States* contain five-eighths of the proportion of the Spanish possessions, and yet their area is not one-half so large. Brazil comprehends tracts of country so desert toward the west, that over an extent only a third less than that of Spanish America, its population is in the proportion of one to four. The following table contains the results of an attempt which I made, conjointly with M. Mathieu, member of the Academy of Sciences, and of the Bureau des Longitudes, to estimate with precision the extent of the surface of the various states of America. We made use of maps, on which the limits had been corrected, according to the statements published in my " Recueil d'Observations Astronomiques." Our scales were, generally speaking, so large that spaces from four to five leagues square were not omitted. We observed this degree of precision that we might not add the uncertainty of the measure of triangles, trapeziums, and the sinuosities of the coasts, to the uncertainty of geographical statements.

[^399]| great political divisions. | SURFACE <br> in square leagues of 20 to an equinoctial degree. | $\begin{aligned} & \text { POPULA- } \\ & \text { TION } \\ & (1823) . \end{aligned}$ |
| :---: | :---: | :---: |
| I. Possessions of the Spanish Americans . | 371,380 | 16,785,000 |
| Mexico or New Spain | 75,830 | 6,800,000 |
| Guatemala | 16,740 | 1,600,000 |
| Cuba and Porto Rico | 4,430 | 800,000 |
| Columbia $\left\{\begin{array}{l}\text { Venezuela }\end{array}\right.$ | 33,700 | 785,000 |
| Columbia New Grenada and Quito | 58,250 | 2,000,000 |
| Peru | 41,420 | 1,400,000 |
| Chili | 14,240 | 1,100,000 |
| Buenos Ayres. | 126,770 | 2,300,000 |
| II. Possessions of the Portuguese Ame. ricans (Brazil). | 256,990 | 4,000,000 |
| 1II. Possessions of the Anglo-Americans (United States) | 174,300 | 10,220,000 |

From the statistical researches which have been made in several countries of Europe, important results have been obtained by a comparison of the relative population of maritime and inland provinces. In Spain these relations are to one another as nine to five; in the United Provinces of Venezuela, and, above all, in the ancient Capitania-General of Caracas, they are as thirty-five to one. How powerful soever may be the influence of commerce on the prosperity of states, and the intellectual development of nations, it would be wrong to attribute in America, as we do in Europe, to that cause alone the differences just mentioned. In Spain and Italy, if we except the fertile plains of Lombardy, the inland districts are arid, and abounding in mountaias or high table-lands: the meteorological circumstances, on which the fertility of the soil depends, are not the same in the lands bordering on the sea, as they are in the central provinces. Colonization in America has generally begun on the coast, and advanced slowly towards the interior; such is its progress in Brazil and in Venezuela. It is only where the coast is unhealthy, as in Mexico and New Grenada, or sandy and exempt from rain as in Peru, that the population is concentrated on the

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mountains, and the table-lands of the interior. These local circumstances are too often overlooked in considerations on the future fate of the Spanish colonies; they communicate a peculiar character to some of those countries, the physical and moral analogies of which are less striking than is commenly supposed. Considered with reference to the distribution of the population, the two provinces of New Grenada and Venezuela, which have been united in one political body, exhibit the most complete contrast. Their capitals (and the position of capitals always denotes where population is most concentrated) are at such unequal distances from the trading coasts of the Caribbean Sea, that the town of Caracas, to be placed on the same parallel with Santa-Fé de Bogota, must be transplanted southward to the junction of the Orinoco with the Guaviare, where the mission of San Fernando de Atabapo is situated.

The republic of Columbia is, with Mexico and Guatemala, the only state of Spanish America which occupies at once the coasts opposite to Europe, and to Asia. From Cape Paria to the western extremity of Veragua is a distance of 400 sea leagues: and from Cape Burica to the mouth of Rio Tumber the distance is 260 . The shore possessed by the republic of Columbia consequently equals in length the line of coasts extending from Cadiz to Dantzic, or from Ceuta to Jaffa. This immense resource for national industry is combined with a degree of cultivation of which the importance has not hitherto been sufficiently acknowledged. The isthmus of Panamil forms part of the territory of Columbia, and that neck of land, if traversed by good roads, and stocked with camels, may one day serve as a portage for the commerce of the world, even though the plains of Cupica, the bay of Mandinga, or the Rio Chagre, should not afford the possibility of a canal for the passage of vessels proceeding from Europe to China,* or from the United Dtates to the north-west coast of America.

When considering the influence which the configuration of countries (that is, the elevation and the form of coasts), exercises in every district on the progress of civilization and the destiny of nations, I have pointed out the disad-

[^401]vantages of those vast masses of triangular continents, which, like Africa and the greater part of South America, are destitute of gulfs and inland seas. It cannot be doubted, that the existence of the Mediterranean has been closely conneeted with the first dawn of human cultivation among the nations of the west, and that the articulated form of the land, the frequency of its contractions, and the concatenation of peninsulas, favoured the civilization of Greece, Italy, and perhaps of all Europe westward of the meridian of the Propontis. In the New World the uninterruptedness of the coasts, and the monotony of their straight lines, are most remarkable in Chili and Peru. The shore of Columbia is more varied, and its spacious gulfs, sueh as that of Paria, Cariaco, Maracaybo, and Darien, were, at the time of the first discovery, better peopled than the rest, and facilitated the interchange of productions. That shore possesses an incalculable advantage in being washed by the Caribbean Sea, a kind of inland sea with several outlets, and the only one pertaining to the New Continent. This basin, whose various shores form portions of the United States, of the republic of Columbia, of Mexico, and several maritime powers of Europe, gives birth to a peculiar, and exclusively American system of trade. The southeast of Asia, with its neighbouring archipelago, and above all, the state of the Mediterranean in the time of the Phonician and Greek colonies, prove that the nearness of opposite coasts, not haring the same productions, and not inhabited by nations of different races, exercises a happy influence on commercial industry and intellectual cultivation. The importance of the inland Caribbean Sea, bounded by Venezuela on the south, will be further augmented by the progressive increase of population on the banks of the Mississippi ; for that river, the Rio del Norte, and the Magdalena, are the only great narigable streams which the Caribbean Sea receives. The depth of the American rivers, their immense branches, and the use of steam-boats, everywhere facilitated by the proximity of forests, will, to a certain extent, compensate for the obstacles which the uniform line of the coasts, and the general configuration of the continent, oppose to the progress of industry and civilization.

On comparing the extent of the territory with the absolute population, we obtain the result of the connection of those two elements of public prosperity, a connection that constitutes the relative population of every state in the New World. We shall find to every square sea league, in Mexico, 90 ; in the United States, 58 ; in the republic of Columbia, 30 ; and in Brazil, 15 inhabitants; while Asiatic Russia furnishes 11; the whole Russian Empire, 87; Sweden with Norway, 90; European Russia, 320 ; Spain, 763; and France, 1778. But these estimates of relative population, when applied to countries of immense extent, and of which a great part is entirely uninhabited, merely furnish mathematical abstractions of but little value. In countries uniformly cultivated-in France, for examplethe number of inhabitants to the square league, calculated by separate departments, is in general only a third, more or less, than the relative population of the sum of all the departments. Even in Spain, the deviations from the average number rise, with few exceptions, only from half to double. In America, on the contrary, it is only in the Atlantic states, from South Carolina to New Hampshire, that the population begins to spread with any uniformity. In that most civilized portion of the New World, from 130 to 900 inhabitants are reckoned to the square league, while the relative population on all the Atlantic states, considered together, is 240. The extremes (North Carolina and Massachussets) are only in the relation of 1 to 7 , nearly as in France, where the extremes, in the departments of the Hautes Alpes and the Côte-du-Nord are also in the relation of 1 to 6.7 . The variations from the average number, which we generally find restricted to narrow limits in the civilized countries of Europe, exceed all measure in Brazil, in the Spanish colonies, and even in the confederation of the United States, in its whole extent. We find in Mexico, in some of the intendencias, for example, La Sonora and Durango, from 9 to 15 inhabitants to the square league, while in others, on the central table-land, there are more than 500 . The relative population of the country situated between the eastern bank of the Mississippi and the Atlantic states, is scarcely 47 ; while that of Connecticut, Rhode Island, and Massachussets, is more than 800. Westward
of the Mississippi, as well as in the interior of Spanish Guiana, there are not two inhabitants to the square league over much larger extents of territory than Switzerland or Belgium. The state of these countries is like that of the Russian Empire, where the relative population of some of the Asiatic governments (Irkutsk and Tobolsk), is to that of the best cultivated European districts, as 1 to 300 .

The enormous difference existing, in countries newly cultivated, between the extent of territory and the number of inhabitants, renders these partial estimates necessary. When we learn that New Spain and the United States, taking their entire extent at 75,000 and 174,000 square sea-leagues, give respectively, 90 and 58 souls to each league, we no more obtain a correct idea of that distribution of the population on which the political power of nations depends, than we should of the climate of a country, that is to say, of the distribution of the heat in the different seasons, by the mere knowledge of the mean temperature of the whole year. If we take from the United States all their possessions west of the Mississippi, their relative population would be 121 instead of 58 to the square league; consequently much greater than that of New Spain. Taking from the latter country the Provincias internas (north and north-east of Nueva Galicia), we should find 190, instead of 90 souls to the square league.

The provinces of Caracas, Maracaybo, Cumana, and Barcelona, that is, the maritime provinces of the north, are the most populous of the old Capitania-General of Caracas; but, in comparing this relative population with that of New Spain, where the two intendencias of Mexico and Puebla alone contain, on an extent scarcely equal to the superficies of the province of Caracas, a greater population than that of the whole republic of Columbia, we see that some Mexican intendencias, which, with respect to the concentration of their culture, occupy but the seventh or eighth rank (Zacatecas and Guadalajara), contain more inhabitants to the square league than the province of Caracas. The average of the relative population of Cumana, Barcelona, Caracas, and Maracaybo, is fifty-six ; and, as 6200 square leagues,'that is, one half of the extent of these four provinces are almost desert Llanos, we find, in reckoning the superficies
and the scanty population of the plains, 102 inhabitants to the square league. An analogous modification gives the province of Caracas alone a relative population of 208, that is, only one-seventh less than that of the Atlantic States of North America.

As in political economy, numerical statements become instructive only by a comparison with analogous facts, I have carefully examined what, in the present state of the two continents, might be considered as a small relative population in Europe, and a rery great relative population in America. I have, however, chosen examples only from among the provinces which have a continued surface of more than 600 square leagues, in order to exclude the accidental aecumulations of population which occur around great cities; for instance, on the coast of Brazil, in the valley of Mexico; on the table-lands of Santa Fé de Bogota and Cuzco; or finally, in the smaller West India Islands (Barbadoes, Martinique, and St. Thomas), of which the relative popula tion is from 3000 to 4700 inhabitants to the square league, and consequently equal to the most fertile parts of Holland; France, and Lombardy.

Minimum of Europe. To the
The four least populous Governments of European Russia: sq. league.

Olonez . . . . . . . . . 42

Wologda and Astracan . , . . . . . 52 Finland . . . . . . . . . 106
The least populous Province of Spain, that of Cuença . . 311
The Duchy of Luneburg (on account of the heaths) . . 550
The least populous Department of Continental France (INautes Alps)
. 758
Departments of France thinly peopled (the Creuse, the Var, and the Aude)

Maximum of America.
The central part of the Intendencias of Mexico and Puebla, above . . . . . . . . . 1300
In the United States, Massachussets, but having only 522 square
leagues of surface . . . . . . . . 900
Massachussets, Rhode Island, and Conneeticut, together . 840
The whole Intendencia of Puebla . . . . . . 540
The whole Intendencia of Mexico . . . . . 460

These two Mexican Intendencias together, are nearly a third of the superficial extent of France. with a suitable population (in 1823, nearly $2,800,000$ souls), to prevent the towns of Mexico and Puebla from having a sensible influence on the relative population.
Northern part of the Province of Caracas (without the Llanos) . 208
This table shews that those parts of America which we now consider as the most populous, attain the relative population of the kingdom of Navarre, of Galicia, and the Asturias, which, next to the province of Guipuscoa, and the kingdom of Valencia, reckon the greatest number of inhabitants to the square league in all Spain; the maximum of America is, however, below the relative population of the whole of France ( 1778 to the square league), and would, in the latter country, be considered as a very thin population. If, taking a survey of the whole surface of America, we direct our attention to the Capitania-General of Venezuela, we find that the most populous of its subdivisions, the province of Caracas, considered as a whole, without excepting the Llanos, has, as yet, only the relative population of Tennessee; and that this province, without the Llanos, furnishes in its northern part, or more than 1800 squares, the relative population of South Carolina. Those 1800 square leagues, the centre of agriculture, are twice as numerously peopled as Finland, but still a third less than the province of Cuença, which is the least populous of all Spain. We cannot dwell on this result without a painful feeling. Such is the state to which colonial politics and mal-administration have, during three centuries, reduced a country, which, for natural wealth, may vie with all that is most wonderful on earth. For a region equally desert, we must look either to the frozen regions of the north, or westward of the Alleghani mountains towards the forests of Tennessee, where the first clearings have only begun within the last eighty years!

The most cultivated part of the province of Caracas, the basin of the lake of Valencia, commonly called Los Valles de Aragua, contained in 1810, nearly 2000 inhabitants to the square league. Supposing a relative population three times less, and taking off from the whole surface of the CapitanisGeneral nearly 24,000 square leagues, as being occupied
by the Llanos and the forests of Guiana, and, therefore, presenting great obstacles to agricultural labourers, we should still obtain a population of six millions for the remaining 9700 square leagues. Those who, like myself, have lived long within the tropics, will find no exaggeration in these calculations; for I suppose for the portion the most easily cultivated, a relative population equal to that in the intendencias of Puebla and Mexico,* full of barren mountains, and extending towards the coast of the Pacific, over regions almost desert. If the territories of Cumana, Barcelona, Caracas, Maracaybo, Varinas, and Guiana, should be destined hereafter to enjoy good provincial and municipal institutions, as confederate states, they will not require a century and a half to attain a population of six millions of inhabitants. Venezuela, the eastern part of the republic of Columbia, would not, even with nine millions, have a more considerable population than Old Spain; and can it be doubted that that part of Venezuela which is most fertile and easy of cultivation, that is, the 10,000 square leagues remaining after deducting the Llanos and the almost impenetrable forests between the Orinoco and the Cassiquiare, could support in the fine climate of the tropics, as many inhabitants as 10,000 square leagues of Estramadura, the Castiles, and other provinces of the table-land of Spain? These predictions are by no means problematical, inasmuch as they are founded on physical analogies and on the productive power of the soil; but before we can indulge the hope that they will be actually accomplished, we must be secure of another element less susceptible of calculation,--that national wisdom which subdues hostile passions, destroys the germs of civil discord, and gives stability to free and energetic institutions.

When we take a view of the soil of Venezuela and New Grenada, we perceive that no other country of Spanish America furnishes commerce with such various and rich productions of the vegetable kingdom. If we add the harvests of the province of Caracas to those of Guayaquil, we find that the republic of Columbia alone can furnish nearly all the cacao annually demanded by Europe. The

[^402]union of Venezuela and New Grenada has also placed in the hands of one people the greater part of the quinquina exported from the New Continent. The temperate mountains of Merida, Santa Fé, Popayan, Quito, and Loxa, produce the finest qualities of this febrifugal bark hitherto known. I might swell the list of these valuable productions by the coffee and indigo of Caracas, so long esteemed in commerce; the sugar, cotton, and flour of Bogota; the ipecacuanha of the banks of the Magdelena; the tobacco of Varinas; the Cortex Angosturm of Caroni; the balsam of the plains of Tolu; the skins and dried provisions of the Llanos; the pearls of Panama, Rio Hacha, and Marguerita; and finally, the gold of Popayan, and the platinum, which is nowhere found in abundance but at Choco and Barbacoa: but contormably with the plan I have adopted, I shall confine myself to the old Capitania-General of Caracas.

Owing to a peculiar disposition of the soil in Venezuela, the three zones of agricultural, pastoral, and hunting-life succeed each other from north to south along the coast in the direction of the equator. Advancing in that direction, we may be said to traverse, in respect to space, the different stages through which the human race has passed in the lapse of ages, in its progress towards cultivation, and in laying the foundations of civilized society. The region of the coast is the centre of agricultural industry; the region of the Llanos serves only for the pasturage of the animals which Europe has given to America, and which live there in a half-wild state. Each of those regions includes from seven to eight thousand square leagues; further south, between the delta of the Orinoco, the Cassiquiare, and the Rio Negro, lies a vast extent of land as large as France, inhabited by hunting nations, covered with thick forests and impassable swamps. The productions of the vegetable kingdom belong to the zones at each extremity; the intermediary savannahs, into which oxen, horses, and mules were introduced about the year 1548, afford food for some millions of those animals. At the time when I visited Venezuela, the annual exportation from thence to the West India Islands amounted to 30,000 mules, 174,000 ox-hides, and 140,000 arrobas (of twenty-
five pounds) of tasajo,* or dried meat slightly salted. It is not from the advancement of agriculture, or the progressive eneroachments on the pastoral lands, that the hatos (herds and flocks) have diminished so considerably within twenty years; it is rather owing to the disorders of every kimd that have prevailed, and the want of security for property. The impunity conceded to the slin-stealers, and the accumulation of marauders in the savannahs, preceded that destruction of cattle eaused by the ravages of civil war, and the supplies required for troops. A very considerable number of goat-skins is exported to the island of Marguerita, Punta Araya, and Corolas; sheep abound only in Carora and Tocuyo. The consumption of meat being immense in this country, the diminution of animals has a greater influence here than in any other district on the well-being of the inhabitants. The town of Caracas, of which the population in my time was one-tenth of that ot Paris, consumed more than one-half the quantity of beef annually used in the capital of France.

I might add to the productions of the vegetable and animal kingdoms of Venezuela the enumeration of the minerals, the working of which is worthy the attention of the government; but having from my youth been engaged in the practical labours of mines, I. know how vague and uncertain are the judgments formed of the metallic wealth of a country from the mere appearance of the rocks, and of the veins in their beds. The utility of such labours can be determined only by well directed experiments, by meana of shafts or galleries. All that has been done in researches of this kind, under the dominion of the mother-country, has left the question wholly undecided, and the most exaggerated ideas have been recently spread through Europe, concerning the riches of the mines of Caracas. The common denomination of Columbia given to Venezuela and

[^403]Ncw Grenada, has doubtless contributed to foster those illusions. It cannot be doubted that the gold-washings of New Grenada furnished, in the last years of public tranquillity, more than 18,000 marks of gold; that Choco and Barbacoa supply platinum in abundance; the valley of Santa Rosa, in the province of Antioquia, the Andes of Quindiu and Gauzum, near Cuença, yield sulphuretted mereury; the table-land of Bogota (near Zipaquira and Canoas), fossil-salt and pit-coal; but even in New Grenada, subterranean labours, on the silver and gold veins, have hitherto been very rare. I am far, however, from wishing to discourage the miners of those countries: I merely conceive that for the purpose of proving to the old world the political imiortance of Venezuela, the amazing territorial wealth of which is founded on agriculture and the produce of pastoral life, it is not necessary to describe as realities, or as the acquisitions of industry, what is, as yet, founded solely on hopes and probabilities, more or less uncertain. The republic of Columbia also possesses on its coast, on the island of Marguerita, on the Rio Hacha, and in the gulf of Panama, pearl fisheries of ancient celebrity. In the present state of things, however, fishing for these pearls is an object of as little importance as the exportation of the metals of Venezuela. The existence of metallic veins on several points of the coast cannot be doubted. Mines of gold and silver were worked at the beginning of the conquest at Buria, near Barquesimeto, in the province of Los Mariches, at Baruta, on the south of Caracas, and at Real de Santa Barbara, near the Villa de Cura. Grains of gold are found in the whole mountainous territory between Rio Yaracuy, the Villa de San Felipe and Nirgua, as well as between Guigue and Los Moros de San Juan. M. Bonpland and myself, during our long journey, saw nothing in the gneiss granite of Spanish Guiana to confrm the old faith in the metallic wealth of that district; jet it seems certain, from several historical notices, that there exist two groups of auriferous alluvial land; one between the sources of the Rio Negro, the Uaupes and the Iquiare; the other between the sources of the Essequibo, the Caroni, and the Rupunuri. Hitherto only one working is found in Venezuela, that of droa: it fur-
nished, in 1800, near 1500 quintals of copper of excellent quality. The green-stone rocks of the transition mountains of Tucutunemo (between Villa de Cura and Parapara), contain veins of malachite and copper pyrites. The indications of both ochreous and magnetic iron in the coastchain, the native alum of Chuparipari, the salt of Araya, the kaolin of the Silla, the jade of the Upper Orinoco, the petroleum of Buen-Pastor, and the sulphur of the eastern part of New Andalusia, equally merit the attention of the government.

It is easy to ascertain the existence of some mineral substances, which afford hopes of profitable working, but it requires great circumspection to decide whether the mineral be sufficiently abundant and accessible to cover the expense.* Even in the eastern part of South America, gold and silver are found dispersed in a manner that surprises the European geologist; but that dispersion, together with the divided and entangled state of the veins, and the appearance of some metals only in masses, render the working extremely expensive. The example of Mexico sufficiently proves that the interest attached to the labours of the mines is not prejudicial to agricultural pursuits, and that those two branches of industry may simultaneously promote each other. The failure of the attempts made under the - intendant, Don Jose Avalo, must be attributed solely to the ignorance of the persons employed by the Spanish government, who mistook mica and hornblende for metallic substances. If the government would order the CapitaniaGeneral of Caracas to be carefully examined during a series of years by men of science, well versed in geognosy and chemistry, the most satisfactory results might be expected.
'The description above given of the productions of Venezuela, and the development of its coast, sufficiently shows

[^404]the importance of the commerce of that rich country. Even under the thraldom of the colonial system, the value of the exported products of agriculture, and of the goldwashings, amount to eleven or twelve millions of piastres, in the countries at present united under the denomination of the Republic of Columbia. The exports of the Capi-tania-General of Caracas alone, exclusive of the precious metals, which are the objects of regular working, was (with the contraband), from five to six millions of piastres, at the beginning of the nineteenth century. Cumana, Barcelona, La Guayro, Porto Cabello, and Maracaybo, are the most important parts of the coast ; those that lie most eastward have the advantage of an easier communication with the Virgin Islands, Guadeloupe, Martinique, and St. Vincent. Angostura, the real name of which is Santo Tomè de Nueva Guiana, may be considered as the port of the rich province of Varinas. The majestic river, on whose banks this town is built, affords by its communications with the Apure, the Meta, and the Rio Negro, the greatest advantages for trade with Europe.

The shores of Venezuela, from the beauty of their ports, the tranquillity of the sea by which they are washed, and the fine timber that covers them, possess great advantages over the shores of the United States. In no part of the world do we find firmer anchorage, or better positions for the establishment of ports. The sea of this coast is constantly calm, like that which extends from Lima to Guayaquil. The storms and hurricanes of the West Indies are never felt on the Costa Firme; and when, after the sun has passed the meridian, thick clouds charged with electricity, accumulate on the mountains of the coasts, a pilot accustomed to these latitudes knows that this threatening aspect of the sky denotes only a squall. The virgin-forests near the sea, in the eastern part of New Andalusia, present valuable resources for the establishment of dockyards. The wood of the mountains of Paria may vie with that of the island of Cuba, Huasacualco, Guayaquil, and San Blas. The Spanish Government, at the close of the last century, fixed its attention on this important object. Marine engineers were sent to mark the finesi trunks of Brazil-wood, mahogany, cedrela, and laurinea, between Angostura and
the mouth of the Orinoco, as well as on the banks of the Gulf of Paria, commonly called the Golfo triste. It was not intended to establish docks on that spot, but to hew the weighty timber into the forms necessary for ship-building. and to transport it to Caraque, near Cadiz. Though trees fit for masts are not found in this country, it was nevertheless hoped that the execution of this project would considerably diminish the importation of timber from Sweden and Norway. The experiment of forming this establishment was tried in a very unhealthy spot, the valley of Quebranta, near Guirie; I have already adverted to the causes of its adestruction. The insalubrity of the place would, doubtless, have diminished in proportion as the forest (el monte virgen), should have been removed from the dwellings of the inhabitants. Mulattos, and not whites, ought to have been employed in hewing the wood, and it should have been remembered that the expense of the roads (arastraderos), for the transport of the timber, when once laid out, would not have been the same, and that, by the increase of the population, the price of day labour would progressively have diminished. It is for ship-builders alone, who determine the localities, to judge whether, in the present state of things, the freight of merchant-vessels be not far too high to admit of sending to Europe large quantities of roughly-hewn wood; but it cannot be doubted that Venezuela possesses on its maritime coast, as well as on the banks of the Orinoco, immense resources for shipbuilding. The fine ships which have been launched from the dockyards of the Havana, Guayaquil, and San Blas, have, no doubt, cost more than those constructed in Europe; but from the nature of tropical wood, they possess the advantages of hardness and amazing durability.

The great struggle during which Venezuela has fought for independence, has lasted more than twelve years. That period has been no less fruitful than civil commotions usually are in heroic and generous actions, guilty errors, and violent passions. The sentiment of common danger has strengthened the ties between men of various races, who, spread over the plains of Cumana, or insulated on the table-land of Cundinamarca, have a physical and moral organization as different as the climates in which they live.

The mother-country has several times regained possession of some districts; but as revolutions are always renewed with more violence when the evils that produce them can no longer be remedied, these conqueats have been transitory. To facilitate and give greater energy to the defence of this country, the governments have been concentrated, and a vast state has been formed, extending from the mouth of the Orinoco to the other side of the Andes of Riobamba, and the banks of the Amason. The Capitania-General of Caracas has been united to the Vice-royalty of New Grenada, from which it was only separated entirely in 1777. This union, which will always be indispensable for externad safety, this centralization of powers in a country six times larger than Spain, has been prompted by political views. The tranquil progress of the new government has justified the wisdom of those views, and the Congress will find still fewer obstacles in the execution of its beneficent projects for national industry and civilization, in proportion as it can grant increased liberty to the provinces, mnst render the people sensible to the advantages of institutions which they have purchased at the price of their blood. In every form of government, in republics as well as in limited monarchies, improvements, to be salutary, must be progressive. New Andalusia, Caracas, Cundinamarea, Popayan, and Quito, are not confederate states like Pennsylvania, Virginia, and Maryland. Without juntas, or provincial legislatures, all those countries are directly subject to the congress and government of Columbia. In conformity with the constitutional act, the intendants and governors of the departments and provinces are nominated by the president of the republic. It may be naturally supposed that such dependence has not always been deemed favourable to the liberty of the communes, which love to discuss their own local interests. The ancient kingdom of Quito, for instance, is connected by the habits and language of its mountainous inhabitants, with Peru and New Grenada. If there were a provincial junta, if the congress alone determined the taxes necessary for the defence and general welfare of Columbia, the feeling of an individual political existence would render the inhabitants less interested in the choice of the spot which is the seat of the central government. The same
argument applies to New Andalusia or Guiana, which are governed by intendants named by the president. It may be said that these provinces have hitherto been in a position differing but little from those territories of the United States which have a population below 60,000 souls. Peculiar circumstances, which cannot be justly appreciated at such a distance, have doubtless rendered great centralization necessary in the civil administration; every change would be dangerous as long as the state has external enemies; but the forms useful for defence, are not always those which, after the struggle, sufficiently favour individual liberty, and the development of public prosperity.

The powerful union of North America has long been insulated, and without contact with any states having analogous institutions. Although the progress America is making from east to west, is considerably retarded near the right bank of the Mississippi, she will advance without interruption towards the internal provinces of Mexico, and will there find a European people of another race, other manners, and a different religious faith. Will the feeble population of those provinces, belonging to another dawning federation, resist; or will it be absorbed by the torrent from the east and transformed into an Anglo-American state, like the inhabitants of Lower Louisiana? The future will soon solve this problem. On the other hand, Mexico is separated from Columbia only by Guatemala, a country and extreme fertility, which has recently assumed the denomination of the republic of Central America. The political divisions between Oaxaca and Chiapa, Costa Rica and Veragua, are notfounded either on the natural limits, or the manners and languagss of the natives, but solely on the habit of dependence on thia Spanish chiefs who resided at Mexico, Guatemala, or Santà Fé de Bogota. It seems natural that Guatemala should one day join the isthmuses of Veragua and Panama to the isthmus of Costa Rica; and that Quito should connect New Grenada with Peru, as La Paz, Charcas, and Potosi link Peru with Buenos-Ayres. The intermediate parts from Chiapa to the Cordilleras of Upper Peru, form a passage from one political association to another, like those transitory forms which link together the various groups of the organie leingdom in nature. In
neighbouring monarchies the provinces that adjoin each other present those striking demarcations which are the effect of great centralization of power: in federal republics, states situated at the extremities of each system are some time before they acquire a stable equilibrium. It would be almost a matter of indifference to the provinces between Arkansas and the Rio del Norte, whether they send their deputies to Mexico or to Washington. Were Spanish America one day to shew a more uniform tendency towards the spirit of federalism, which the example of the United States has created on several points, there would result from the contact of so many systems, or groups of states, confederations variously graduated. I here only touch on the relations that arise from this assemblage of colonies on an uninterrupted line of 1600 leagues in length. We have seen, in North America, one of the old Atlantic states divided into two, and each having a different representation. The separation of Maine and Massachusets, in 1820, was effected in the most peaceable manner. Schisms of this kind will, it may be feared, render such changes turbulent. It may also be observed, that the importance of the geographical divisions of Spanish America, founded at the same time on the relations of local position and the habits of several centuries, have prevented the mother-country from retarding the separation of the colonies by attempting to establish Spanish princes in the New World. In order to rule such vast possessions it would have been requisite to form six or seven centres of government; and that multiplicity of centres was hostile to the establishment of new dynasties, at the period when they might still have been salutary to the mother country.

Bacon somewhere observes, that it would be happy if nations would always follow the example of time, the greatest of all innovators, but who acts calmly, and almost without being perceived. This happiness does not belong to colonies when they reach the critical juncture of emancipation; and least of all to Spanish America, engaged in the struggle at first, not to obtain complete independence, but to escape from a foreign yoke. May these party agitations be succeeded by a lasting tranquillity! May the germ of civil discord, disseminated during three centuries VOL. III.
to secure the dominion of the mother-country, gradually, perish; and may productive and commercial Europe be convinced that to perpetuate the political agitations of the New World would be to impoverish herself by diminishing the consumption of her productions, and losing a market which already yields more than seventy millions of piastres. Many years must no doubt elapse before seventeen millions of inhabitants, spread over a surface one-fifth greater than the whole of Europe, will have found a stable equilibrium in governing themselves. The most critical moment is that when nations, after long oppression, find themselves suddenly at liberty to promote their own prosperity. The Spanish Americans, it is unceasingly repeated, are not sufficiently advanced in intellectual cultivation to be fitted for free institutions. I remember that at a period not very remote, the same reasoning was applied to other nations, who were said to have made too great an advance in civilization. Experience, no doubt, proves that nations, like individuals, find that intellect and learning do not always lead to happiness; but without denying the necessity of a certain mass of knowledge and popular instruction for the stability of republics or constitutional monarchies, we believe that stability depends much less on the degree of intellectual improvement than on the strength of the national character; on that balance of energy and tranquillity of ardour and patience, which maintains and perpetuates new institutions; on the local circumstances in which a nation is placed; and on the political relations of a country with neighbouring states.

## CHAPTER XXVIII.

Passage from the Coast of Venezuela to the Havannah.-General View of the Population of the West India Islands, compared with the Population of the New Continent, with respect to diversity of races, personal liberty, language, and worship.

We sailed from Nueva Barcelona on the 24th of November, at nine o'clock in the evening; and we doubled the small rocky island of Borachita. The night was marked by that coolness which characterizes the nights of the tropics; and the agreeable effect of which can only be conceived by comparing the nocturnal temperature, from $23^{\circ}$ to $24^{\circ}$ centigrade, with the mean temperature of the day, which in those latitudes is generally, even on the coast, from $28^{\circ}$ to $29^{\circ}$. Next day, soon after the observation of noon, we reached the meridian of the island of Tortugas. It is destitute of vegetation; and like the little islands of Coche and Cabagua, is remarkable for its small elevation above the level of the sea.

In the forenoon of the 26 th we began to lose sight of the island of Marguerita, and I endeavoured to verify the height of the rocky group of Macanao. It appeared under an angle of $0^{\circ} 16^{\prime} 35^{\prime \prime}$; which in a distance estimated at sisty miles, would give the mica-slate group of Macanao the elevation of about 660 toises, a result which, in a zone where the terrestrial refractions are so unchanging, leads me to think that the island was less distant than we supposed. The dome of the Silla of Caracas, lying $62^{\circ}$ to the S.W., long fixed our attention. At those times when the coast is not loaded with vapours, the Silla must be visible at sea, without reckoning the effects of refraction, at thirty-three leagues distance. During the 26th, and the three following days, the sea was covered with a bluish film, which, when examined by a compound microscope, appeared formed of an innumerable quantity of filaments. We frequently find these filaments in the Gulf-stream, and the Channel of Bahama, as well as near the coast of Buenos Ayres. Some naturalists are of opinion that they are vestiges of the eggs of mollusca: but they appear to be more like fragments of fuci. The phosphorescence of sea-water seems however to
be augmented by their presence, especially between $28^{\circ}$ and $30^{\circ}$ of north latitude, which indicates an origin of some sort of animal nature.

On the 27th, we slowly approached the island of Orchila. Like all the small islands in the vicinity of the fertile coast of the continent, it has never been inhabited. I found the latitude of the northern cape, $11^{\circ} 51^{\prime} 44^{\prime \prime}$ and the longitude of the eastern cape, $68^{\circ} 26^{\prime} 5^{\prime \prime}$ (supposing Nueva Barcelona to be $67^{\circ} 4^{\prime} 48^{\prime \prime}$ ). Opposite the western cape there is a small rock against which the waves beat turbulently. Some angles taken with the sextant, gave, for the length of the island from east to west, 8.4 miles ( 950 toises) ; and for the breadth scarcely three miles. The island of Orchila, which, from its name, I figured to myself as a bare rock covered with lichens, was at that period beautifully verdant. The hills of gneiss were covered with grasses. It appears that the geological constitution of Orchila resexables, on a small scale, that of Marguerita. It consists of two groups of rocks joined by a neck of land; it is an isthmus covered with sand, which seems to have issued from the floods by the successive lowering of the level of the sea. The rocks, like all those which are perpendicular and insulated in the middle of the sea, appear much more elevated than they really are, for they scarcely exceed from 80 to 90 toises. The Punta rasa stretches to the north-west, and is lost, like a sandbank, below the waters. It is dangerous for navigators, and so is likewise the Mogote, which, at the distance of two miles from the western cape, is surrounded by breakers. On a very near examination of these rocks, we saw the strata of gneiss inclined towards the northwest, and crossed by thick layers of quartz. The destuction of these layers has doubtless created the sands of the surrounding beach. Some clumps of trees shade the valleys, the summits of the hills are crowned with fan-leaved palmtrees; probably the palma de sombrero of the Llanos (Corypha tectorum). Rain is not abundant in these countries; but probably some springs might be found on the island of Orchila, if sought for with the same care as in the mica-slate rocks of Punta Araya. When we recollect how many bare and rocky islands are inhabited and cultivated between the 17 th and 26 th degrees of latitude in the
archipelago of the Lesser Antilles and Bahama Islands, we are surprised to find those islands desert, which are near the coast of Cumana, Barcelona, and Caracas. They would long have ceased to be so had they been under the dominion of any other govermment than that to which they belong. Nothing can engage men to circumscribe their industry within the narrow limits of a small island, when a neighbouring continent offers them greater advantages.
We perceived, at sunset, the two points of the Roca de afuera, rising like towers in the midst of the ocean. A survey taken with the compass, placed the most easterly of the points or roques at $0^{\circ} 19^{\circ}$ west of the western cape of Orchila. The clouds continued long accumulated over that island, and showed its position from afar. The influence of a small tract of land in condensing the vapours suspended at an elevation of 800 toises, is a very extraordinary phenomenon, although familiar to all mariners. From this accumulation of clouds, the position of the lowest island may be recognized at a great distance.

On the 29th November, we still saw very distinctly, at sunrise, the summit of the Silla of Caracas just rising above the horizon of the sea. At noon everything denoted a change of weather in the direction of the north : the atmosphere suddenly cooled to $12 \cdot 6^{\circ}$, while the sea maintained a temperature of $25.6^{\circ}$, at its surface. At the moment of the observation of noon, the oscillations of the horizon, crossed by streaks or black bands of very variable size, produced changes of refraction from $3^{\circ}$ to $4^{\circ}$. The sea became rough in very calm weather, and everything announced a stormy passage between Cayman Island and Cape St. Antonio. On the 30th the wind veered suddenly to N.N.E., and the surge rose to a considerable height. Northward, a darkish blue tint was observable on the sky, the rolling of our small vessel was violent, and we perceived amidst the dashing of the waves, two seas crossing each other, one from the north and the other from N.N.E. Waterspouts were formed at the distance of a mile, and were carried rapidly from N.N.E. to N.N.W. Whenever the waterspout drew near us, we felt the wind grow sensibly cooler. Towards evening, owing to the carelessness of our American cook, our deck took fire; but fortunately it was soon extinguished.

On the morning of the 1st of December, the sea slowly calmed, and the breeze became steady from N.E. On the 2nd December we descried Cape Beata, in a spot where we had long observed the clouds gathered together. According to the observations of Acherner, which I obtained in the night, we were sixty-four miles distant. During the night there was a very curious optical phenomenon, which I shall not undertake to account for. At half-past midnight the wind blew feebly from the east; the thermometer rose to $23 \cdot 2^{\circ}$, the whalebone hygrometer was at $57^{\circ}$. I had remained upon the deck to observe the culmination of some stars. The full-moon was high in the heavens. Suddenly, in the direction of the moon, $45^{\circ}$ before its passage over the meridian, a great arch was formed tinged with the prismatic colours, though not of a bright hue. The arch appeared higher than the moon; this iris-band was near $2^{\circ}$ broad, and its summit seemed to rise nearly from $80^{\circ}$ to $85^{\circ}$ above the horizon of the sea. The sky was singularly pure ; there was no appearance of rain; and what struck me most was, that this phenomenon, which perfectly resembled a lunar rainbow, was not in the direction opposite to the moon. The arch remained stationary, or at least appeared to do so, during eight or ten minutes; and at the moment when I tried if it were possible to see it by reflection in the mirror of the sextant, it began to move and descend, crossing successively the Moon and Jupiter. It was $12^{\mathrm{h}} 54^{\mathrm{m}}$ (mean time) when the summit of the arch sank below the horizon. This movement of an arch, coloured like the rainbow, filled with astonishment the sailors who were on watch on the deck. They alleged, as they do on the appearance of every extraordinary meteor, that it denoted wind. M. Arago examined the sketch of this arch in my journal; and he is of opinion that the image of the moon reflected in the waters could not have. given a halo of such great dimensions. The rapidity of the. movement is no small obstacle in the way of explanation of a phenomenon well worthy of attention.

On the 3rd of December we felt some uneasiness on account of the proximity of a small vessel supposed to be a pirate, but which, as it drew near, we recognized to be the Balandra del Frayle, (the sloop of the Monk). I was at a loss to
conceive what so strange a denomination meant. The bark belonged to a Franciscan missionary, a rich priest of an Indian village in the savannahs (Llanos) of Barcelona, who had for several years carried on a very lucrative contraband trade with the Danish islands. M. Bonpland; and several passengers, saw in the night at the distance of a quarter of a mile, with the wind, a small flame on the surface of the ocean; it ran in the direction of S.W. and lighted up the atmosphere. No shock of earthquake was felt, and there was no change in the direction of the waves. Was it a phosphoric gleam produced by a great accumulation of mollusca in a state of putrefaction ; or did this flame issue from the depth of the sea, as is said to have been sometimes observable in latitudes agitated by volcanoes? The latter supposition appears to me devoid of all probability. The volcanic flame can only issue from the deep when the rocky bed of the ocean is already heaved up, so that the flames and incandescent scoriæ escape from the swelled and creviced part, without traversing the waters.
At half-past ten in the morning of the 4th of December we were in the meridian of Cape Bacco (Punta Abacou), which I found in $76^{\circ} 7^{\prime} 50^{\prime \prime}$, or $9^{\circ} 3^{\prime} 2^{\prime \prime}$, west of Nueva Barcelona. Having attained the parallel of $17^{\circ}$, the fear of pirates made us prefer the direct passage across the bank of Vibora, better known by the name of the Pedro Shoals. This bank occupies more than two hundred and eighty square sea leagues, and its configuration strikes the eye of the geologist, by its resemblance to that of Jamaica, which is in its neighbourhood. It forms an island almost as large as Porto Rico.

From the 5th of December, the pilots believed they took successively the measurement at a distance of the island of Ranas (Morant Keys), Cape Portland, and Pedro Keys. They may probably have been deceived in several of these distances, which were taken from the mast-head. I have elsewhere noted these measurements, not with the view of opposing them to those which have been made by able English navigators, in these frequented latitudes, but merely to connect, in the same system of observations, the points 1 determined in the forests of the Orinoco, and in the archipelago of the West Indies. The milky colour of the waters warned us
that we were on the eastern part of the bank; the centigrade thermometer, which at a distance from the bank, and on the surface of the sea, had for several days, kept at $27^{\circ}$ and $27.3^{\circ}$ (the air being at $212^{\circ}$ ), sank sudidenly to $25 \cdot 7^{\circ}$. The weather was bad from the 4th to the 6th of December: it rained fast ; thunder rolled at a distance, and the gusts of wind from the N.N.E. became more and more violent. We were during some part of the night in a critical position; we heard before us the noise of the breakers over which we had to pass, and we could ase rtain their direction by the phosphoric gleam reflected from the foam of the sea. The scene resembled the Raudal of Garzita, and other rapids which we had seen in the bed of the Orinoco. We succeeded in changing our course, and in less than a quarter of an hour were out of danger. While we traversed the bank of the Vibora, from S.S.E. to N.N.W., I repeatedly tried to ascertain the temperature of the water on the surface of the sea. The cooling was less sensible on the middle of the bank than on its edge, a circumstance which we attributed to the currents that there mingle waters from different latitudes. On the south of Pedro Keys, the surface of the sea, at twenty-five fathoms deep, was $26 \cdot 4^{\circ}$ and at fifteen fathoms deep $26 \cdot 2^{\circ}$. The temperature of the sea on the east of the bank had been $26 \cdot 8^{\circ}$. Some American pilots affirm, that among the Bahama Islands they often know, when seated in the cabin, that they are passing over sand-banks; they allege that the lights are surrounded with small coloured halos, and that the air exhaled from the lungs is visibly condensed. The latter circumstance appears very doubtful; below $30^{\circ}$ of latitude the cooling produced by the waters of the bank is not sufficiently considerable to cause this phenomenon. During the time we passed on the bank of the Vibora, the constitution of the air was quite different from what it had been when we quitted it. The rain was circumscribed by the limits of the bank, of which we could distinguish the form from afar, by the mass of vapour with which it was covered.

On the 9th of December, as we advanced towards the Cayman Islands,* the north-east wind again blew with

[^405]violence. I nevertheless obtained some altitudes of the sun, at the moment when we believed ourselves, though twelve miles distant, in the meridian of the centre of the Great Cayman, which is covered with cocoa-trees.

The weather continued bad, and the sea extremely rough. The wind at length fell, as we neared Cape St. Antonio. I found the northern extremity of the cape $87^{\circ} 17^{\prime} 22^{\circ}$, or $2^{\circ} 34^{\prime} 14^{\circ}$, eastward of the Morro of the Havannah : this is the longitude now marked on the best charts. We were at the distance of three miles from land, but we were made aware of the proximity of the island of Cuba, by a delicious aromatic odour. The sailors affirm that this odour is not perceived when they approach from Cape Catoche, on the barren coast of Mexico. As the weather grew clearer, the thermometer rose gradually in the shade to $27^{\circ}$ : we advanced rapidly northward, carried on by a current from south-south-east, the temperature of which rose at the surface of the water to $26.7^{\circ}$; while out of the current it was $24.6^{\circ}$. We anchored in the port of the Havannah, on the 19th December, after a passage of twenty-five days in continuous bad weather.

## CHAPTER XXIX.

Political Essay on the island of Cuba.-The Havannah.-Hills of Guanavacoa, considered in their geological relations.-Valley of Los Guines. Batabano, and Port of Trinidad.-The King and Queen's Gardens.

Cuba owes its political importance to a varrety of circumstances, among which may be enumerated the extent of its surface, the fertility of its soil, its naval establishments, and the nature of its population, of which three-fifths are free men. All these advantages are heightened by the admirable position of the Havannah. The northern part of the Caribbean Sea, known by the name of the Gulf of Mexico, forms a circular basin more than two hundred and fifty leagues in diameter: it is a Mediterranean with two outlets. The island of Cuba, or rather its coast between Cape St. Antonio and the town of Matanzas, situated at
the opening of the old channel, closes the Gulf of Mexico on the south-east, leaving the ocean current, known by the name of the Gulf Stream, no other outlet on the south than a strait between Cape St. Antonio and Cape Catoche; and no other on the north than the channel of Bahama, between Bahia-Honda and the shoals of Florida. Near the northern outlet, where the highways of so many nations may be said to cross each other, lies the fine port of the Havannah, fortified at ouce by nature and by art. The fleets which sail from this port, and which are partly constructed of the cedrela and the mahogany of the island of Cuba, might, at the entrance of the Mexican Mediterrancan, menace the opposite coast, as the flects that sail from Cadiz command the Atlantic near the Pillars of Hercules. In the meridian of the Havannah, the Gulf of Mexico, the old channel, and the channel of Bahama unite. The opposite direction of the currents, and the violent agitations of the atmosphere at the setting-in of winter, impart a peculiar character to these latitudes, at the extreme limit of the equinoctial zone.

The island of Cuba is the largest of the Antilles.* Its long and narrow form gives it a vast development of coast, and places it in proxinity with Hayti and Jamaica, with the most southern province of the United States (Florida), and the most easterly province of the Mexican Confederation (Yucatan). $\dagger$ This circumstance claims serious attention, when it is considered that Jamaica, St. Domingo, Cuba, and the southern parts of the United States (from Louisiana to Virginia), contain nearly two millions eight hundred thousand Africans. Since the separation of St. Domingo, the Floridas, and New Spain from the mother-country, the island of Cuba is connected only by similarity of religion, language, and manners, with the neighbouring countries, which, during ages, were subject to the same laws.

Florida forms the last link in that long chain, the northern extremity of which reaches the basin of St. Lawrence, and extends from the region of palm-trees to that of

[^406]the most rigorous winter. The inhabitant of New Eigland regards the increasing augmentation of the black population, the preponderance of the slave states, and the predilection for the cultivation of colonial products, as a public danger; and earnestly wishes that the strait of Florida, the present limit of the great American confederation, may never be passed but with the views of free trade, founded on equal rights. If he fears events which may place the Havannah under the dominion of a European power more formidable than Spain, he is not the less desirous that the political ties by which Louisiana, Pensacola, and Saint Augustin of Florida, were heretofore united to the island of Cuba, may for ever be broken.

The extreme sterility of the soil, joined to the want of inhabitants and of cultivation, have at all times rendered the proximity of Florida of small importance to the trade of the Havannah; but the case is different on the coast of Mexico. The shores of that country, stretching in a semicircle from the frequented ports of Tampico, Vera Cruz, and Alvarado, to Cape Catoche, almost touch, by the peninsula of Yucatan, the western part of the island of Cuba. Commerce is extremely active between the Havannah and the port of Campeachy; and it increases, notwithstanding the new order of things in Mexico, because the trade, equally illicit with a more distant coast, that of Caracas or Columbia, employs but a small number of vessels. In such difficult times, the supply of salt meat (tasajo), for the slaves, is more easily obtained from Buenos Ayres, and the plains of Merida, than from those of Cumana, Barcelona, and Caracas. The island of Cuba, and the archipelago of the Philippines, have for ages derived from New Spain the funds necessary for their internal administration, and for keeping up their fortifications, arsenals, and dockyards. The Havannah was the military port of the Now World; and, till 1808, annually received $1,800,000$ piastres from the Mexican treasury. At Madrid, it was long the custom to consider the island of Cuba and the archipelago of the Philippines, as dependencies on Mexico, situated at very unequal distances east and west of Vera Cruz and Acapulco, but linked to the Mexican metropolis (then a European colony), by all the ties of commerce, mutual aid, and ancient sympathies. Increased internal wealth has
rendered unnecessary the pecuniary succour formerly furnished to Cuba from the Mexican treasury. Of all the Spanish possessions, that island has been most prosperous: the port of the Havannah has, since the troubles of St. Domingo, become one of the most important points of the commercial world. A fortunate concurrence of political circumstances, joined to the intelligence and commercial activity of the inhabitants, have preserved to the Havannah the uninterrupted enjoyment of free intercourse with foreign nations.

I twice visited this island, residing there on one occasion for three months, and on the other for six weeks; and I enjoyed the confidence of persons, who, from their abilities and their position, were enabled to furnish me with the best information. In company with M. Bonpland I visited only the vicinity of the Havannah, the beautiful valley of Guines, and the coast between Batabano and the port of Trinidad. After having succinctly described the aspect of this scenery, and the singular modifications of a climate so different from that of the other islands, I will proceed to examine the general population of the Island of Cuba; its area, calculated from the most accurate sketch of the coast; the objects of trade, and the state of the public revenue.

The aspect of the Havannah, at the entrance of the port, is one of the gayest and most picturesque on the shore of equinoctial America, north of the equator. This spot is celebrated by travellers of all nations. It boasts not the luxuriant vegetation that adorns the banks of the river Guayaquil, nor the wild majesty of the rocky coast of Rio de Janeiro; but the grace which in those climates embellishes the scenes of cultivated nature, is at the Havannah mingled with the majesty of vegetable forms, and the organic vigour that characterizes the torrid zone. On entering the port of the Havannah you pass between the fortress of the Morro (Castillo de los Santos Reyes), and the fort of San Salvador de la Punta: the opening being only from one hundred and seventy to two hundred toises wide. Having passed this narrow entrance, leaving on the north the fine castle of San Carlos de la Cabaña, and the Casa Blanca, we reach a basin in the form of a trefoil, of which the great axis, stretching from S.S.W. to N.N.E., is two miles and one-fifth long. This
basin communicates with three creeks, those of Regla, Guanavacoa, and Atares; in this last there are some springs of fresh water. The town of the Havannah, surrounded by walls, forms a promontory bounded on the south by the arsenal, and on the north by the fort of La Punta. After passing beyond some wrecks of vessels sunk in the shoals of La Luz, we no longer find eight or ten, but five or six fathoms of water. The castles of Santo Domingo de Atares and San Carlos del Principe, defend the town on the westward; they are distant from the interior wall, on the land side, the one 660 toises, the other 1240. The intermediate space is filled by the suburbs (arrabales or barrios extra muros) of the Horcon, Jesu-Maria, Guadaloupe, and Señor de la Salud, which from year to year encroach on the Field of Mars (Campo de Marte). The great edifices of the Havannah, the cathedral, the Casa del Govierno, the house of the commandant of the marine, the Correo or General Post Office, and the Factory of Tobacco, are less remarkable for beauty than for solidity of structure. The streets are for the most part narrow and unpaved. Stones being brought from Vera Cruz, and very difficult of transport, the idea was conceived a short time before my voyage, of joining great trunks of trees together, as is done in Germany and Russia, when dykes are constructed across marshy places. This project was soon abandoned, and travellers newly arrived beheld with surprise fine trunks of mahogany sunk in the mud of the Havannah. At the time of my sojourn there, few towns of Spanish America presented, owing to the want of a good police, a more unpleasant aspect. People walked in mud up to the knee; and the multitude of caleches or volantes (the characteristic equipage of the Havannah), of carts loaded with casks of sugar, and porters elbowing passengers, rendered walking most disagreeable. The smell of tasajo often poisons the houses and the winding streets. But it appears that of late the police has interposed, and that a manifest improvement has taken place in the cleanliness of the streets; that the houses are more airy, and that the Calle de los Mercadores presents a fine appearance. Here, as in the oldest towns of Europe, an ill-traced plan of streets can only be amended by slow degrees.

There are two fure public walks; one called the Alameda,
between the hospital of Santa Paula and the theatre, and the other between the Castillo de la Punta and the Puerta de la Muralla, called the Paseo extra muros; the latter is deliciously cool, and is frequented by carriages after sunset. It was begun by the Marquis de la Torre, governor of the island, who gave the first impulse to the improvement of the police and the municipal government. Don Luis de las Casas, and the Count de Santa Clara, enlarged the plantations. Near the Campo de Marte is the Botanical Garden, which is well worthy to fix the attention of the government; and another place fitted to excite at once pity and indig-uation,-the barracoon, in front of which the wretched slaves are exposed for sale. A marble statue of Charles III. has been erected, since my return to Europe, in the extra muros walk. This spot was at first destined for a monument to Christopher Columbus, whose ashes, after the cession of the Spanish part of St. Domingo, were brought to the island of Cuba." The same year the ashes of Fernando Cortez were transferred in Mexico from one church to another: thus, at the close of the eighteenth century, the remains of the two greatest men who promoted the conquest of America were interred in new sepulchres.

The most majestic palm-tree of its tribe, the palma real, imparts a peculiar character to the landscape in the vicinity of the Havannah ; it is the Oreodoxa regia of our description of American palm-trees. Its tall trunk, slightly swelled towards the middle, grows to the height of 60 or 80 feet; the upper part is glossy, of a delicate green, newly formed by

* Columbus lies buried in the cathedral of the Havannah, close to the wall near the high altar. On the tomb is the following inscription :

> "O restos y Imagen del grande Colon; Mil siglos duran guardados en la Urna, Y en remembraņa de nuestra Nacion."
> " Oh relics and image of the great Colon (Columbus) A thousand ages are encompassed in thy Urn, And in the memory of our Nation."

His remains were first deposited at Valladolid, and thence were removed to Seville. In 1536, the bodies of Columbus and of his son Diego (El Adelantado) were carried to St. Domingo, and there interred in the cathedral; but they were afterwards removed to the place where they now repose.
the closing and dilatation of the petioles, contrasts with the rest, which is whitish and fendilated. It appears like two columns, the one surmounting the other. The palma real of the island of Cuba has feathery leaves rising perpendicularly towards the sky, and curved only at the point. The form of this plant reminded us of the vadgiai palm-tree, which covers the rocks in the cataracts of the Orinoco, balancing its long points over a mist of foam. Here, as in every place where the population is concentrated, vegetation diminishes. Those palm-trees round the Havannah, and in the amphitheatre of Regla, on which I delighted to gaze, are disappearing by degrees. The marshy places which I saw covered with bamboos, are cultivated and drained. Civilization advances; and the soil, gradually stripped of plants, scarcely offers any trace of its wild abundance. From the Punta to San Lazaro, from Cabaña to Regla, and from Regla to Atares, the road is covered with houses, and those that surround the bay are of light and elegant construction. The plan of these houses is traced out by the owners, and they are ordered from the United States, like pieces of furniture. When the yellow fever rages at the Havannah, the proprietors withdraw to those country houses, and to the hills between Regla and Guanavacoa, to breathe a purer air. In the coolness of night, when the boats cross the bay, and owing to the phosphorescence of the water, leave behind them long tracks of light, these romantic scenes afford charming and peaceful retreats for those who wish to withdraw from the tumult of a populous city. To judge of the progress of cultivation travellers should visit the small plots of maize, and other alimentary plants, the rows of pine-apples (ananas) in the fields of Cruz de Piedra, and the bishop's garden (Quinta del Obispo), which of late is become a delicious spot.

The town of the Havannah, properly so called, surrounded bs walls, is only 900 toises long, and 500 broad; yet more than 44,000 inhabitants, of whom 26,000 are negroes and mulattoes, are crowded together in this narrow space. $\mathbf{A}$ population nearly as considerable occupies the two great suburbs of Jesu-Maria and La Salud.* The latter place does not verify the name it bears; the temperature of the air is indeed lower than in the city, but the streets might

[^407]have been larger and better planned. Spanish engineers, who have been waging war for thirty years past with the inhabitants of the suburbs (arrabales), have convinced the government that the houses are too near the fortifications, and that the enemy might establish himself there with impunity. But the government has not courage to demolish the suburbs, and disperse a population of 28,000 inhabitants coilected in La Salud only. Since the great fire of 1802 that quarter bas been considerably enlarged; barracks were at first constructed, but by degrees they have been converted into private houses. The defence of the Havannah on the west is of the highest importance: so long as the besieged are masters of the town, properly so called, and of the southern part of the bay, the Morro and La Cabaña, they are impregnable, because they can be provisioned by the Havannah, and the losses of the garrison repaired. I have heard wellinformed French engineers observe, that an enemy should pegin his operations by taking the town, in order to bombard the Cabaña, a strong fortress, but where the garrison, shut up in the casemates, could not long resist the insalubrity of the climate. The English took the Morro without being masters of the Havannah; but the Cabaña and the Fort No. 4, which commands the Morro did not then exist. The most important works on the south and west, are the Castillos de Atares y del Principe, and the battery of Santa Clara.

We employed the months of December, January, and February, in making observations in the vicinity of the Havannah and the fine plains of Guines. We experienced, in the family of Señor Cuesta (who then formed with Señor Santa Maria, one of the greatest commercial houses in America), and in the house of Count O'Reilly, the most generous hospitality. We lived with the former, and deposited our collections and instruments in the spacious hotel of Count O'Reilly, where the terraces favoured our astronomical observations. The longitude of the Havannah was at this period more than one fifth of a degree uncertain.* It had been fixed by M. Espinosa, the learned

[^408]director of the Deposito hidrografico of Madrid, at $5^{\circ} \mathbf{3 8}^{\prime}$ 11", in a table of positions which he communicated to me on leaving Madrid. M. de Churruca fixed the Morro at $5^{\text {h }} 39^{\prime} 1^{\prime \prime}$. I met at the Havannah with one of the most able officers of the Spanish navy, Captain Don Dionisio Galeano, who had taken a survey of the coast of the strait of Magellan. We made observations together, on a series of eclipses of the satellites of Jupiter, of which the mean result gave $5^{\mathrm{h}} 38^{\prime} 50^{\prime \prime}$. M. Oltmanns deduced in 1805; the whole of those observations which I marked for the Morro, at $5^{\mathrm{h}} 38^{\prime} 525^{\prime \prime}-84^{\circ} 43^{\prime} 7 \cdot 5^{\prime \prime}$ west of the meridian of Paris. This longitude was confirmed by fifteen nccultations of stars observed from 1809 to 1811, and calculated by M. Ferrer: that excellent observer fixes the definitive result at $5^{\circ} 38^{\prime}$ $50.9^{\prime \prime}$. With respect to the magnetic dip, I found it by the compass of Borda (Dec. 1800), $53^{\circ} 22^{\prime \prime}$ of the old sexagesimal division: twenty-two years before, according to the very accurate observations made by Captain Sabine, in his memorable voyage to the coasts of Africa, America, and Spitzbergen, the dip was only $51^{\circ} 55^{\prime}$; it had therefore diminished $1^{\circ} 27^{\prime}$.

The island of Cuba being surrounded with shoals and breakers, along more than two-thirds of its length, and as ships keep out byond those dangers, the real shape of the island was for a long time unknown. Its breadth, especially between the Havannah and the port of Batabano, has been exaggerated; and it is only since the Deposito hidrografico of Madrid published the observations of captain Don Jose del Rio, and lieutenant Don Ventura de Barcaiztegui, that the area of the island of Cuba could be calculated with any accuracy. Wishing to furnish in this work the most accurate result that can be obtained in the present state of our astronomical knowledge, I engaged M. Bauza to calculate the area. He found, in June, 1835, the surface of the island of Cuba, without the Isla dos Pinos, to be 3520 square sea leagues, and with that island 3615. From this calculation, which has been twice repeated, it results, that the island of Cuba is one-seventh less than has

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hitherto been believed; that it is $\frac{32}{100}$ larger than Hayti, or San Domingo ; that its surface equals that of Portugal, and within one-eighth that of England without Wales; and that if the whole arehipelago of the Antilles presents as great an area as the half of Spain, the island of Cuba alone almost equals in surface the other Great and Small Antilles. Its greatest length, from Cape San Antonio to Point Maysi (ina direction from W.S.W. to E.N.E. and from W.N.W to E.S.E.) is 227 leagues ; and its greatest breadth (in the direction N. and S.), from Point Maternillo to the mouth of the Magdalena, near Peak Tarquino, is 37 leagues. The mean breadth of the 1sland, on four-ifths of its length, between the Havannah and Puerto Principe, is 15 leagues. In the best cultivated part, between the Havannah and Batabano, the isthmus is only eight sea leagues. Among the great islands of the globe, that of Java most resembles the island of Cuba in its form and area ( 4170 square leagues). Cuba has a circumference of coast of 520 leagues, of which 280 belong to the south shore, between Cape San Antonio and Punta Maysi.

The island of Cuba, over more than four-fifths of its surface, is composed of low lands. The soil is covered with secondary and tertiary formations, formed by some rocks of gneiss-granite, syenite, and euphotide. The knowledge obtained hitherto of the geologic configuration of the country, is as unsatisfactory as what is known respecting the relative age and nature of the soil. It is only ascertained that the highest group of mountains lies at the south-eastern extremity of the island, between Cape Cruz, Punta Maysi, and Holguin. This mountainous part, called the Sierra, or Las Montañas del Cobre, (the Copper Mountains) situated north-west of the town of Santiago de Cuba, appears to be about 1200 toises in height. If this calculation be correct, the summits of the Sierra would command those of the Blue Mountains of Jamaica, and the peaks of La Selle and La Hotte, in the island of San Domingo. The Sierra of Tarquino, fifty miles west of the town of Cuba, belongs to the some group as the Copper Mountains. The island is crossed from E.S.E. to W.N.W. by a chain of hills, which approach the southern coast between the meridians of La Ciudad de Puerto Principe and the Villa Clara; while, further to the
westward towards Alvarez and Matanzas, they stretch in the direction of the northern coast. Proceeding from the mouth of the Rio Guaurabo to the Villa de la Trinidad, I saw on the north-west, the Lomas de San Juan, which form needles or horns more than 300 toises high, with their declivities sloping regularly to the south. This calcareous group presents a majestic aspect, as seen from the anchorage near the Cayo de Piedras. Xagua and Batabano are low coasts; and I believe that, in general, west of the meridian of Matanzas, there is no hill more than 200 toises high, with the exception of the Pan de Guaixabon. The land in the interior of the island is gently undulated, as in England; and it rises only from 45 to 50 toises above the level of the sea. The objects most visible at a distance, and most celebrated by navigators, are the Pan de Matanzas, a truncated cone which has the forin of a small monument; the Arcos de Canasi, which appear between Puerto Escondido and Jaruco, like small segments of a circle; the Mesa de Mariel, the Tetas de Managua, and the Pan de Guaixabon. This gradual slope of the limestone formations of the island of Cuba towards the north and west indicates the submarine connection of those rocks with the equally low lands of the Bahama Islands, Florida, and Yucatan.

Intellectual cultivation and improvement were so long restricted to the Havannah and the neighbouring districts, that we cannot be surprised at the ignorance prevailing among the inhabitants respecting the geologic formation of the Copper Mountains. Don Francisco Ramirez, a traveller versed in chemical and mineralogical science, informed me that the western part of the island is granitic, and that he there observed gneiss and primitive slate. Probably the alluvial deposits of auriferous sand which were explored with so much ardour* at the beginning of the conquest, to the

* At Cubanacan, that is, in the interior of the island, near Jagua and Trinidad, where the auriferous sands have been washed by the waters as far as the limestone soil. Martyr d'Anghiera, the most intelligent writer on the Conquest, says: "Cuba is richer in gold than Hispaniols (San Domingo); and at the moment I am writing, 180,000 castillanos of ore have been collected at Cuba." Herrera estimates the tax called King'sfift (quinto del Rey), in the island of Cuba, at 6000 pesos, which indicates an annual product of 2000 marks of gold, at 22 carats; and conseM 2
great misfortune of the natives came from those granitic formations; traces of that sand are still found in the rivers Holguin and Escambray, known in general in the vicinity of Villa-Clara, Santo Espiritu, Puerto del Principe de Bayamo, and the Bahia de Nipe. The abundance of copper mentioned by the Conquistadores of the sixteenth century, at a period when the Spaniards were more attentive than they have been in latter times to the natural productions of America, may possibly be attributed to the formations of amphibolic slate, transition clay-slate mixed with diorite,
quently purer than the gold of Sibao in San Domingo. In 1804, the mines of Mexico altogether produced 7000 marks of gold; and those of Peru 3400. It is difficult, in these calculations, to distinguish between the gold sent to Spain by the first Conquistadores, that obtained by washings, and that which had been accumulated for ages in the hands of the natives, who were pillaged at will. Supposing that in the two islands of Cuba and San Domingo (in Cubanacan and Cibao), the product of the washings was 3000 marks of gold, we find a quantity three times less than the gold furnished annually ( 1790 to 1805) by the small province of Choco. In this supposition of ancient wealth there is nothing improbable; and if we are surprised at the scanty produce of the gold-washings attempted in our days at Cuba and San Domingo, which were beretofore so prolific, it must be recollected that at Brazil also, the product of the gold-washings has fallen, from 1760 to 1820, from 6600 gold kilogrammes to less than 595. Lumps of gold weighing several pounds, found in our days in Florida and North and South Carolina, prove the primitive wealth of the whole basin of the Antilles, from the island of Cuba to the Apallachian chain. It is also natural that the product of the gold-washings should diminish with greater rapidity than that of the subterraneous working of the veins. The metals not being renewed in the clefts of the veins (by sublimation) now accumulate in alluvial soil, by the course of the rivers where the table-lands are higher than the level of the surrounding running waters. But in rocks with metalliferous veins, the miner does not at once know all he has to work. He may chance to lengthen the labours, to go deep, and to cross other accompanying veins. Alluvial soils are generally of small depth where they are auriferous; they most frequently rest upon sterile rocks. Their superficial position and uniformity of composition help to the knowledge of their limits, and wherever workmen can be collected, and where the waters for the washings abound, accelerate the total working of the auriferous clay. These considerations, suggested by the history of the Conquest, and by the science of mining, may throw some light on the problem of the metallic wealth of Hayti. In that island, as well as at Brazil, it would be more profitable to attempt subterraneous workings (on veins) in primitive and intermediary soils, than to renew the gold-washings which were abandoned in the ages of barbarism, rapine, and carnage.
and to euphotides, analogous to those I found in the mountains of Guanabacoa.

The central and western parts of the island contain two formations of compact limestone; one of clayey sandstone, and another of gypsum. The former has, in its aspect and composition, some resemblance to the Jura formation. It is white, or of a clear ochre-yellow, with a dull fracture, sometimes conchoidal, sometimes smooth; divided into thin layers, furnishing some balls of pyromac silex, often hollow, (at Rio Canimar, two leagues east of Matanzas), and petrifications of pecten, cardites, terebratules, and madrepores.* I found no oolitic beds, but porous beds almost bulbous, between the Potrero del Conde de Mopox, and the port of Batabano, resembling the spongy beds of Jura limestone in Franconia, near Dondorf, Pegnitz, and Tumbach. Yellowish cavernous strata, with cavities from three to four inches in diameter, alternate with strata altogether compact, $\dagger$ and poorer in petrifications. The chain of hills that borders the plain of Guines on the north, and is linked with the Lomas de Camua, and the Tetas de Managua, belongs to the latter variety, which is reddish white, and almost of lithographic nature, like the Jura limestone of Pappenheim. The compact and cavernous beds contain nests of brown ochreous iron; possibly the red earth (tierra colorada) so much sought for by the coffee planters (haciendados) owes its origin to the decomposition of some superficial beds of oxidated iron, mixed with silex and clay, or to a reddish sandstone $\ddagger$ superposed on limestone. The whole of this formation, which I shall designate by the name of the limestone of Guines, to distinguish it from another much more recent, forms, near Trinidad, in the Lomas of St. Juan, steep declivities, resembling the mountains of limestone of Caripe, in the vicinity of Cumana. They also contain great caverns, near Matanzas and Jaruco, where I have not heard that any fossil bones have been found. The frequency of

[^410]caverns in which the pluvial waters accumulate, and where small rivers disappear, sometimes causes a sinking of the earth. I am of opinion that the gypsum of the island of Cuba belongs, not to tertiary, but to secondary soil; it is worked in several places on the east of Matanzas, at San Antonia de los Baños, where it contains sulphur, and at the Cayos, opposite San Juan de los Remedios. We must not confound with this limestone of Guines, sometimes porous, sometimes compact, another formation so recent, that it seems to augment in our days. I allude to the calcareous agglomerates, which I saw in the islands of Cayos that border the coast between the Batabano and the bay of Xagua, principally south of the Cienega de Zapata, Cayo Buenito, Cayo Flamenco, and Cayo de Piedras. The soundings prove that they are rocks rising abruptly from a bottom of between twenty and thirty fathoms. Some are at the water's edge, others one-fourth or one-fifth of a toise above the surface of the sea. Angular fragments of madrepores, and cellularia from two to three cubic inches, are found cemented by grains of quartzose sand. The inequalities of the rocks are covered by mould, in which, by help of a microscope, we only distinguish the detritus of shells and corals. This tertiary formation no doubt belongs to that of the coast of Cumana, Carthagena, and the Great Land of Guadaloupe, noticed in my geognostic table of South America.* MM. Chamiso and Guiamard have recently thrown great light on the formation of the coral islands in the Pacific. At the foot of the Castillo de la Punta, near the Havannah, on shelves of cavernous rocks, $t$ covered with verdant sea-

[^411]weeds and living polypi, we find enormons masses of madropores and other lithophyte corals set in the texture of those shelves. We are at first tempted to admit, that the whole of this limestone rock, which constitutes the principal portion of the island of Cuba, may be traced to an uninterrupted operation of nature,- to the action of productive organic forces-an action which continues in our days in the bosom of the ocean; but this apparent novelty of limestone formations soon vanishes when we quit the shore, and recollect the series of coral rocks which contain the formations of different ages, the muschelkalk, the Jura limestone, and coarse limestone. The same coral rocks as those of the Castillo and La Punta are found in the lofty inland mountains, accompanied with petrifications of bivalve shells, very different from those now seen on the coasts of the Antilles. Without positively assigning a determinate place in the table of formations to the limestone of Guines, which is that of the Castillo and La Punta, I have no doubt of the relative antiquity of that rock with respect to the calcareous agglomerate of the Cayos, situated south of Batabano, and east of the island of Pinos. The globe has undergone great revolutions between the periods when these two soils were formed; the one containing the great caverns of Matanzas, the other daily augmenting by the agglutination of fragments of coral and quartzose sand. On the south of the island of Cuba, the latter soil seems to repose sometimes on the Jura limestone of Guines, as in the Jardinillos, and sometimes (towards Cape Cruz) immediately over primitive rocks. In the lesser Antilles, the corals are covered with volcanic productions. Several of the Cayos of the island of Cuba contain fresh water; and I found this water very good in the middle of the Cayo de Piedras. When we reflect on the extreme smallness of these islands, we can scarcely believe that the fresh-water wells are filled with rain-water not evaporated.
to the manganese which we recognize by some dendrites? The sea, entering into the clefts of the rocks, and in a cavern at the foot of the Castillo del Morro, compresses the air, and makes it issue with a tremendous noise. This noise explains the phenomena of the " baxos roncadores," (snoring bocabecos), so well known to navigators who cross from Jamaica to the mouth of Rio San Juan of Nicaragua, or to the island of San Andrès.

Do they prove a submarine communication between the limestone of the coast with the limestone serving as the basis of lithophyte polypi, and is the fresh water of Cuba raised up by hydrostatic pressure across the coral rocks of Cayos; as it is in the bay of Xagua, where, in the middle of the sea, it forms springs frequented by the lamantins?

The secondary formations on the east of the Havannah are pierced in a singular manner by syenitic and euphotide rocks united in groups. The southern bottom of the bay, as well as the northern part (the hills of the Morro and the Cabaña), are of Jura limestone; but on the eastern bank of the two Ensenadas de Regla and Guanabacoa, the whole is transition soil. Going from north to south, and first near Marimelena, we find syenite consisting of a great quantity of hornblende, partly decomposed, a little quartz, and a reddish-white feldspar seldom crystallized. This fine syenite, the strata of which inclne to the north-west, alternates twice with serpentine. The layers of intercalated serpentine are three toises thick. Farther south, towards Regla and Guanabacoa, the syenite disappears, and the whole soil is covered with serpentine, rising in hills from thirty to forty toises high, and running from east to west. This rock is much fendillated, externally of a bluish-grey, covered with dendrites of manganese, and internally of leek and asparagus-green, crossed by small veins of asbestos. It contains no garnet or amphibole, but metalloid diallage disseminated in the mass. The serpentine is sometimes of an esquillous, sometimes of a conchoidal fracture: this was the first time I had found metalloid diallage within the tropics. Several blocks of serpentine have magnetic poles; others are of such a homogeneous texture, and have such a glossiness, that at a distance they may be taken for pechstein (resinite). It were to be wished that these fine masses were employed in the arts, as they are in several parts of Germany. In approaching Guanabacoa, we find serpentine crossed by veins between twelve and fourteen inches thick, and filled with fibrous quartz, amethyst, and fine mammelonnes, and stalactiforme chalcedonies; it is possible that chrysoprase may also one day be found. Some copper pyrites appear among these veins, accompanied, it is said, by silvery-grey copper. I found no traces of this
grey copper : it is probably the metalloid diallage that has given the Cerro de Guanabacoa the reputation of riches in gold and silver, which it has enjoyed for ages. In some places, petroleum flows* from rents in the serpentine. Springs of water are frequent; they contain a little sulphuretted hydrogen, and deposit oxide of iron. The Baths of Bareto are agreeable, but of nearly the same temperature as the atmosphere. The geologic constitution of this group of serpentine rocks, from its insulated position, its veins, its connection with syenite, and the fact of its rising up across shell-formations, merits particular attention. Feldspar with a basis of souda (compact feldspar), forms, with diallage, the euphotide and serpentine ; with pyroxene, dolerite and basalt; and with garnet, eclogyte. These five rocks, dispersed over the whole globe, charged with oxidulated and titanious iron, are probably of similar origin. It is easy to distinguish two formations in the euphotide; one is destitute of amphibole, even when it alternates with amphibolic rocks (Joria in Piedmont, Regla in the island of Cuba), rich in pure serpentine, in metalloid diallage, and sometimes in jasper (Tuscany, Saxony) ; the other, strongly charged with amphibole, often passing to dioritet, has no jasper in layers, and sometimes contains rich veins of copper, (Silesia, Mussinet in Piedmont, the Pyrenees, Parapara in Venezuela, Copper Mountains of North America). It is the latter formation of euphotide which, by its mixture with diorite, is itself linked with hyperthenite, in which real beds of serpentine are sometimes developed m Scotland

[^412]and in Norway. No volcanic rocks of a more recent period have hitherto been discovered in the island of Cuba; for instance, neither trachytes, dolerites, nor basalts. I know not whether they are found in the rest of the Great Antilles, of which the geologic constitution differs essentially from that of the series of calcareous and volcanic islands, which stretch from Trinidad to the Virgin Islands. Earthquakes, which are in general less fatal at Cuba than at Porto Rico and Hayti, are most felt in the eastern part, between Cape Maysi, Santiago de Cuba, and La Ciudad de Puerto Principe. Perhaps towards those regions the action of the crevice extends laterally, which is believed to cross the neck of granitic land between Port-au-Prince and Cape Tiburon, and on which whole mountains were overthrown, in 1770 .

The cavernous texture of the limestone formations (soboruco) just described, the great inclination of the shelvings, the smallness of the island, the nakedness of the plains, and the proximity of the mountains that form a lofty chain on the southern coast, may be considered as among the principal causes of the want of rivers, and the drought which is felt, especially in the western part of Cuba. In this respect, Hayti, Jamaica, and several of the Lesser Antilles, which contain volcanic heights covered with forests, are more favoured by nature. The lands most celebrated for their fertility are the districts of Xagua, Trinidad, Matanzas, and Mariel. The valley of Guines owes its reputation to artificial irrigation (sanjas de riego). Notwithstanding the want of great rivers, and the unequal fertility of the soil, the island of Cuba, by its undulated surface, its continually renewed verdure, and the distribution of its vegetable forms, presents at every step the most varied and beautiful landscape. Two trees, with large, tough, and glossy leaves, the Mammea and the Calophyllum calaba, five species of palm-trees (the palma real, or Oreodoxa regia, the common cocoa-tree, the Cocos crispa, the Corypha miraguama, and the C. maritima), and small shrubs constantly loaded with flowers, decorate the hills and the savannahs. The Cecropia peltata marks the humid spots. It would seem as if the whole island had been origmally a forest of palm, lemon, and wild orange trees. The latter, which
bear a small fruit, are probably anterior to the amrival of Europeans*, who transported thither the agrumi of the gardens; they rarely exceed the height of from ten to fifteen feet. The lemon and orange trees are most frequently separate ; and the new planters, in clearing the ground by fire, distinguish the quality of the soil, according as it is covered with one or other of those groups of social plants; they prefer the soil of the naranjal to that which produces the small lemon. In a country where the making of sugar is not sufficiently improved to admit of the employment of any other fuel than the bagasse (dried sugar-cane), the progressive destruction of the small woods is a positive calamity. The aridity of the soil augments in proportion as it is stripped of the trees that sheltered it from the heat of the sun; for the leaves, emitting heat under a sky always serene, occasion, as the air cools, a precipitation of aqueous vapours.

Among the few rivers worthy of attention, the Rio Guines may be noticed, the Rio Armendaris or Chorrera, of which the waters are led to the Havannah by the Sanja de Antoneli; the Rio Canto, on the north of the town of Bayamo; the Rio Maximo, which rises on the east of Puerto Principe; the Rio Sagua Grande, near Villa Clara; the Rio de las Palmas, which issues opposite Cayo Galiado; the small rivers of Jaruco and Santa Cruz, between Guanabo and Matanzas, navigable at the distance of some miles from their mouths, and favourable for the shipment of sugar-casks; the Rio San Antonio, which, like many others, is engulfed in the caverns of limestone rocks; the Rio Guaurabo, west of the port of Trinidad; and the Rio Galafre, in the fertile district of Filipinas, which throws itself into the Laguna de Cortez. The most abundant springs rise on the southern coast, where, from Xagua to Punta de Sabina, over a length of forty-six leagues, the soil is extremely marshy. So great is the abundance of the

[^413]waters which filter by the clefts of the stratified rock, that from the effect of an hydrostatic pressure, fresh water springs far from the coast, and amidst salt water. The jurisdiction of the Havannah is not the most fertile part of the island; and the few sugar-plantations that existed in the vicinity of the capital, are now converted into farms for cattle, (potreros), and fields of maize and forage, of which the profits are considerable. The agriculturists of the island of Cuba distinguish two kinds of earth, often mixed together like the squares of a draught-board, black earth (negra o prieta) clayey and full of moisture, and red earth (bermeja), more silicious, and containing oxide of iron. The tierra negra is generally preferred (on account of its best preserving humidity), for the cultivation of the sugarcane, and the tierra bermeja for coffee; but many sugar plantations are established on the red soil.

The climate of the Havannah is in accordance with the extreme limits of the torrid zone: it is a tropical climate, in which a more unequal distribution of heat at different parts of the year, denotes the passage to the climates of the temperate zone. Calcutta (lat. $22^{\circ} 34^{\prime} \mathrm{N}$.) Canton (lat. $\left.23^{\circ} 8^{\prime} \mathrm{N}.\right)$ Macao (lat. $22^{\circ} 12^{\prime} \mathrm{N}$. .), the Havannah (lat. $23^{\circ} 9^{\prime} \mathrm{N}$.), and Rio Janeiro (lat. $22^{\circ} 54^{\prime} \mathrm{S}$.) are places which, from their position, at the level of the ocean, near the tropics of Cancer and Capricorn, consequently at an equal distance from the equator, afford great facilities for the study of meteorology. This study can only advance by the determination of certain numerical elements, which are the indispensable basis of the laws we seek to discover. The aspect of vegetation being identical near the limits of the torrid zone, and at the equator, we are accustomed to confound vaguely the climates of two zones comprized between $0^{\circ}$ and $10^{\circ}$, and between $15^{\circ}$ and $23^{\circ}$ of latitude. The region of palm-trees, bananas, and aborescent gramina, extends far beyond the two tropics: but it would be dangerous to apply what has been observed at the extremity of the tropical zone, to what may take place in the plains near the equator. In order to rectify those errors, it is important that the mean temperature of the year and months be well known, as also the thermometric oscillations in different seasons at the parallel of the

Havannah; and to prove by an exact comparison with other points alike distant from the equator, for instance, with Rio Janeiro and Macao, that the lowering of temperature observed in the island of Cuba is owing to the irruption, and the stream of layers of cold air, borne from the temperate zones towards the tropics of Cancer and Capricorn. The mean temperature of the Havannah, according to four years of good observations, is $25.7^{\circ}$ ( $20.6^{\circ}$ R.), only $2^{\circ}$ cent. above that of the regions of America nearest the equator. The proximity of the sea raises the mean temperature of the year on the coast; but in the interior of the island, when the north winds penetrate with the same force, and where the soil rises to the height of forty toises, the mean temperature attains only $23^{\circ}$ ( $18.4^{\circ}$ R.), and does not exceed that of Cairo and Lower Egypt. The difference between the mean temperature of the hottest and coldest months, rises to $12^{\circ}$ in the interior of the island; at the Havannah, and on the coast, to $8^{\circ}$; at Cumana, to scarcely $3^{\circ}$. The hottest months, July and August, attain $28.8^{\circ}$, at the island of Cuba, perhaps $29.5^{\circ}$ of mean temperature, as at the equator. The coldest months are December and January; their mean temperature, in the interior of the island, is $17^{\circ}$; at the Havannah, $21^{\circ}$, that is, $5^{\circ}$ to $8^{\circ}$ below the same months at the equator, yet still $3^{\circ}$ above the hottest month at Paris.

It will be interesting to compare the climate of the Havannah with that of Macao and Rio Janeiro; two places, one of which is near the limit of the northern torrid zone, on the eastern coast of Asia; and the other on the eastern coast of America, towards the extremity of the southern torrid zone.

The climate of the Havannah, notwithstanding the frequency of the north and north-west winds, is hotter than that of Macao and Rio Janeiro. The former partakes of the cold which, owing to the frequency of the west winds, is felt in winter along all the eastern coast of a great continent. The proximity of spaces of land, covered with mountains and table-lands, renders the distribution of heat in different months of the year, more unequal at Macao and Canton, than in an island bounded on the west and north by the hot waters of the Gulf-stream. The winters are therefore much colder at Canton and Macao than at the

Havannah: yet the latitude of Macao is $1^{\circ}$ more southerly than that of the Havannah; and the latter town and Canton are, within nearly a minute, on the same parallel. The thermometer at Canton has sometimes almost reached the point zero; and by the effect of reflection, ice has been found on the terraces of houses. Although this great cold never lasts more than one day, the English merchants residing at Canton, like to make chimney-fires in their apartments from November to January; while at the Havannah, the artificial warmth even of a brazero is not required. Hail is frequent, and the hail-stones are extremely large in ths, Asiatic climate of Canton and Macao, while it is scarcely seen once in fifteen years at the Havannah. In these three places the thermometer sometimes keeps up for several hours between $0^{\circ}$ and $4^{\circ}$ (cent.); and yet, (a circumstance which appears to be very remarkable), snow has never been seen to fall; and notwithstanding the great lowering of the temperature, the bananss and the palm-trees are as beautiful around Canton, Macao, and the Havannah, as in the plains nearest the equator.

In the island of Cuba the lowering of the temperature lasts only during intervals of such short duration, that in general neither the banana, the sugar-cane, nor other productions of the torrid zone, suffer much. We know how well plants of vigorous organization resist temporary cold, and that the orange trees of Genoa survive the fall of snow, and endure cold which does not more than exeeed $6^{\circ}$ or $7^{\circ}$ below freezing-point. As the vegetation of the island of Cuba bears the character of the regetation of the regions near the equator, we are surprized to find even in the plains a vegetable form of the temperate climates, and mountains of the equatorial part of Mexico. I have often directed the attention of botanists to this extraordinary phenomenon in the geography of plants. The pine (Pinus occidentalis) is not found in the Lesser Antilles; not even in Jamaica (between 173 $\frac{1}{4}^{\prime \prime}$ and 18 $\frac{1^{\prime}}{}$ of latitude). It is only seen further north, in the mountains of San Domingo, and in all that part of the island of Cuba, situated between $20^{\circ}$ and $23^{\circ}$ lat. It attains a height of from sixty to seventy feet; and it is remarkable that the cahoba* (mahogany), and the pine vegetate at the island

* Swieteinia Mahogani, Linn.
of Pinos, in the same plains. We also find pines in the south-eastern part of the island of Cuba, on the declivity of the Copper Mountains, where the soil is barren and sandy. The interior table-land of Mexico is covered with the same species of coniferous plants; at least the specimens brought by M. Bonpland and myself from Acaguisotla, Nevado de Toluca, and Cofre de Perote, do not appear to differ specifically from the Pinus occidentalis of the West India Islands, described by Schwartz. Now those pines which we see at sea level in the island of Cuba, in $20^{\circ}$ and $22^{\circ}$ of latitude, and which belong only to the southern part of that island, do not descend on the Mexican continent between the parallels of $17 \frac{1}{2}^{\circ}$ and $19 \frac{1}{2}^{\circ}$, below the elevation of 500 toises. I even observed that, on the road from Perote to Xalapa, in the eastern mountains opposite to the island of Cuba, the limit of the pines is 935 toises; while in the western mountains, between Chilpanzingo and Acapulco, near Quasiniquilapa, two degrees further south, it is 580 toises, and perhaps on some points, 450. These anomalies of stations are very rare in the torrid zone, and are probably less connected with the temperature than with the nature of the soil. In the system of the migration of plants, we must suppose that the Pinus occidentalis of Cuba came from Yucatan before the opening of the channel between Cape Catoche and Cape San Antonio, and not from the United States, so rich in coniferous plants; for in Florida the species of which we have here traced the botanical geography, has not been discovered.

About the end of April, M. Bonpland and myself, having completed the observations we proposed to make at the northern extremity of the torrid zone, were on the point of proceeding to Vera Cruz with the squadron of Admiral Ariztizabal; but being misled by false intelligence respecting the expedition of Captain Baudin, we were induced to relinquish the project of passing through Mexico on our way to the Philippine Islands. The public journals announced that two French sloops, the "Géographe" and the "Naturaliste," had sailed for Cape Horn; that they were to proceed along the coasts of Chili and Peru, and thence to New Holland. This intelligence revived in my mind all the projects I had formed during my stay in Paris,
when I solicited the Directory to hasten the departure of Captain Baudin. On leaving Spain, I had promised to rejoin the expedition wherever I could reach it. M. Bonpland and I resolved instantly to divide our herbals into three portions, to avoid exposing to the risks of a long voyage the objects we had obtained with so much difficulty on the banks of the Orinoco, the Atabapo, and the Rio Negro. We sent one collection by way of England to Germany, another by way of Cadiz to France, and a third remained at the Havannah. We had reason to congratulate ourselves on this foresight : each collection contained nearly the same species, and no precautions were neglected to have the cases, if taken by English or French vessels, remitted to Sir Joseph Banks, or to the professors of natural history at the Museum at Paris. It happened fortunately that the manuscripts which I at first intended to send with the collection to Cadiz, were not intrusted to our much esteemed friend and fellow traveller, Fray Juan Gonzales, of the order of the Observance of St. Francis, who had followed us to the Havannah with the view of returning to Spain. He left the island of Cuba soon after us, but the vessel in which he sailed foundered on the coast of Africa, and the cargo and crew were all lost. By this event we lost some of . the duplicates of our herbals, and what was more important, all the insects which M. Bonpland had with great difficulty collected during our voyage to the Orinoco and the Rio Negro. By a singular fatality, we remained two years in the Spanish colonies without receiving a single letter from Europe; and those which arrived in the three following years made no mention of what we had transmitted. The reader may imagine my uneasiness for the fate of a journal which contained astronomical observations, and barometrical measurements, of which I had not made any copy. After having visited New Grenada, Peru, and Mexico, and just when I was preparing to leave the New Continent, I happened, at a public library of Philadelphia, to cast my eyes on a scientific publication, in which I found these words: "Arrival of M. de Humboldt's manuscripts at his brother's house in Paris, by way of Spain!" I could scarcely suppress an exclamation of joy.

While M. Bonpland laboured day and night to divide and
put our collections in order, a thousand obstacles arose to impede our departure. There was no vessel in the port of the Havannah that would convey us to Porto Bello or Carthagena. The persons I consulted seemed to take pleasure in exaggerating the difficulties of the passage of the isthmus, and the dangerous voyage from Panama to Guyaquil, and from Guyaquil to Lima and Valparaiso. Not being able to find a passage in any neutral vessel, I freighted a Catalonian sloop, lying at Batabano, which was to be at my disposal to take me either to Porto Bello or Carthagena, according as the gales of Saint Martha might permit.* The prosperous state of commerce at the Havannah, and the multiplied connections of that city with the ports of the Pacific, would facilitate for me the means of procuring funds for several years. General Don Gonzalo O'Farrill resided at that time in my native country, as minister of the court of Spain. I could exchange my revenues in Prussia for a part of his at the island of Cuba; and the family of Don Ygnacio O'Farrill y Herera, brother of the general, concurred kindly in all that could favour my new projects. On the 6th of March, the vessel I had freighted was ready to receive us. The road to Batabano led us once more by Guines to the plantation of Rio Blanco, the property of Count Jaruco y Mopox.

The road from Rio Blanco to Batabano runs across an uncultirated country, half covered with forests; in the open spots, the indigo plant and the cotton-tree grow wild. As the capsule of the Gossypium opens at the season when the northern storms are most frequent, the down that envelops the seed is sirept from one side to the other; and the gathering of the cotton, which is of a very fine quality, suffers greatly. Several of our friends, among whom was Señor de Mendoza, captain of the port of Valparaiso, and brother to the celebrated astronomer who resided so long in London, accompanied us to Potrero de Mopox. In herborizing further southward, we found a new palm-tree with fan-leaves, (Corypha maritima), having a free thread between the interstices of the folioles. This Corypha covers a part of the southern coast, and takes place of the majestic palma * The gales of Saint Martha blow with great violence at that season below latitude $12^{\circ}$.
real* and the Cocos crispa of the northern coast. Porous limestone (of the Jura formation) appeared from time to time in the plain.

Batabano was then a poor village, and its church had been completed only a few years previously. The Sienega begins at the distance of half a league from the village; it is a tract of marshy soil, extending from the Laguna de Cortez as far as the mouth of the Rio Xagua, on a length of sixty leagues from west to east. At Batabano it is be-
lieved that in those regions the sea continues to gain upon the land, and that the oceanic irruption was particularly remarkable at the period of the great upheaving which took place at the end of the eighteenth century, when the tobacco mills disappeared, and the Rio Chorrera changed its course. Nothing can be more gloomy than the aspect of these marshes around Batabano. Not a shrub breaks the monotony of the prospect: a few stunted trunks of palmtrees rise like broken masts, amidst great tufts of Juncem and Irides. As we staid only one night at Batabano, I regretted much that I was unable to obtain precise information relative to the two species of crocodiles which infest the Sienega. The inhabitants give to one of these animals the name of cayman, to the other that of crocodile; or, as they say commonly in Spain, of cocodrilo. They assured us that the latter has most agility, and measures most in height: his snout is more pointed than that of the cayman, and they are never found together. The crocodile is very courageous, and is said to climb into boats when he can find a support for his tail. He frequently wanders to the distance of a league frorh the Rio Cauto and the marshy coast of Xagua, to devour the pigs on the islands. This animal is sometimes fifteen feet long, and will, it is said, pursue a man on horseback, like the wolves in Europe; while the animals exclusively called caymans at Batabano, are so timid, that people bathe without apprehension in places where they live in bands. These peculiarities, and the name of cocodrilo, given at the island of Cuba, to the most dangerous of the carnivorous reptiles, appear to me to indicate a different species from the great animals of the Orinoco, Rio Magdalena, and Saint Domingo. In other parts of the Spanish $\cdots i_{i}=$

[^414]American continent, the settlers, deceived by the exaggerated accounts of the ferocity of crocodiles in Egypt, allege that the real crocodile is only found in the Nile. Zoologists have however, ascertained that there are in America caymans or alligators with obtuse snouts, and legs not indented, and crocodiles with pointed snouts and indented legs; and in the old continent, both crocodiles and gaviales. The Crocodilus acutus of San Domingo, in which I cannot hitherto specifically distinguish the crocodiles of the great rivers of the Orinoco and the Magdalena, has, according to Cuvier, so great a resemblance to the crocodile of the Nile,* that it required a minute examination to prove that the rule laid down by Buffon relative to the distribution of species between the tropical regions of the two continents, was correct.

On my second visit to the Havannah, in 1804, I could not return to the Sienega of Batabano; and therefore I had the two species, called caymans and crocodiles by the inhabitants, brought to me, at a great expense. Two crocodiles arrived alive; the oldest was four feet three inches long; they had been caught with great difficulty, and were conveyed, muzzled and bound, on a mule, for they were exceedingly vigorous and fierce. In order to observe their habits and movements, $\dagger$ we placed them in a great hall, where, by climbing on a very high piece of furniture, we cculd see them attack great dogs. Having seen much of crocodiles during six months, on the Orinoco, the Rio Apure, and the Magdalena, we were glad to have another opportunity of observing their habits before our return to Europe. The animals sent to us from Batabano had the snout nearly as sharp as the crocodiles of the Orinoco and the Magdalena (Crocodilus

[^415]acutus, Cuv.) ; their colour was dark-green on the back, and white below the belly, with yellow spots on the flanks. I counted, as in all the real crocodiles, thirty-eight teeth in the upper jaw, and thirty in the lower; in the former, the tenth and ninth; and in the latter, the first and fourth, were the largest. In the description made by M. Bonpland and myself, on the spot, we have expressly marked that the lower fourth tooth rises over the upper jaw. The posterior extremities were palmated. These crocodiles of Batabano appeared to us to be specifically identical with the Crocodilus acutus. It is true that the accounts we heard of their habits did not quite agree with what we had ourselves observed on the Orinoco; but carnivorous reptiles of the same species are milder and more timid, or fiercer and more courageous, in the same river, according to the nature of the localities. The animal called the cayman, at Batabano, died on the way, and was not brought to us, so that we could make no comparison of the two species.* I have no doubt that the crocodile with a sharp snout, and the alligator or cayman with a snout like a pike, $\dagger$ inhabit together, but in distinct bands, the marshy coast between Xagua, the Surgidero of Batabano, and the island of Pinos. In that island Dampier was struck with the great difference between the caymans and the American crocodiles. After having described, though not always with perfect correctness, several of the characteristics which distinguish crocodiles from caymans, he traces the geographical distribution of those enormous saurians. "In the bay of Campeachy," he says, "I saw only caymans or alligators; at the island of Great Cayman, there are crocodiles and no alligators; at the island of Pinos, and in the innumerable creeks of the coast

[^416]of Cuba, there are both crocodiles and caymans."* To these valuable observations of Dampier, I may add that the real crocodile (Crocodilus acutus) is found in the West India Islands nearest the main land, for instance, at the island of Trinidad; at Marguerita; and also, probably, at Curaçao, notwithstanding the want of fresh water. It is obscrved, further south, in the Neveri, the Rio Magdalena, the Apure, and the Orinoco, as far as the confluence of the Cassiquiare with the Rio Negro (lat. $2^{\circ} 2^{\prime}$ ), consequently more than four hundred leagues from Batabano. It would be interesting to verify on the eastern coast of Mexico and Guatimala, between the Mississippi and the Rio Chagres (in the isthmus of Panama), the limit of the different species of carnivorous reptiles.

We set sail on the 9th of March, somewhat incommoded by the extreme smallness of our vessel, which afforded us no sleeping-place but upon deck. The cabin (camera de pozo) received no air or light but from above; it was merely a hold for provisions, and it was with difficulty that we could place our instruments in it. The thermometer kept up constantly at $32^{\circ}$ and $33^{\circ}$ (centesimal.) Luckily these inconveniences lasted only twenty days. Our several voyages in the canoes of the Orinoco, and a passage in an American vessel laden with several thousand arrobas of salt meat dried in the sun had rendered us not very fastidious.

The gulf of Batabano, bounded by a low and marshy coast, looks like a vast desert. The fishing birds, which are generally at their post whilst the small land birds, and the indolent vulturest are at roost, are seen only in small numbers. The sea is of a greenish-brown hue, as in some of the lakes of Switzerland; while the air, owing to its extreme purity, had, at the moment the sun appeared above the horizon, a cold tint of pale blue, similar to that which landscape painters observe at the same hour in the south of Italy, and which makes distant objects stand out in strong relief. Our sloop was the only vessel in the gulf; for the roadstead of Batabano is scarcely visited except by smug-glers, or, as they are here politely called, "the traders," (los tratantes). The projected canal of Guines will render * Dampier's Voyages and Descriptions (1599).
$\dagger$ Vultur aura.

Batabano an important point of communication between the island of Cuba and the coast of Venezuela. The port is within a bay bounded by Punta Gorda on the east, and by Punta de Salinas on the west: but this bay is itself only the upper or concave end of a great gulf measuring nearly fourteen leagues from 'south to north, and along an extent of fifty leagues (between the Laguna de Cortez and the Cayo de Piedras) inclosed by an incalculable number of flats and chains of rocks. One great island only, of which the superficies is more than four times the dimensions of that of Martinique, with mountains crowned with majestic pines, rises amidst this labyrinth. This is the island of Pinos, called by Columbus El Evangelista, and by some mariners of the sixteenth century, the Isla de Santa Maria. Itiscelebrated for its mahogany (Swietenia mahagoni) which is an important article of commerce. We sailed E.S.E., taking the passage of Don Cristoval, to reach the rocky island of Cayo de Piedras, and to clear the archipelago, which the Spanish pilots, in the early times of the conquest, designated by the names of Gardens aud Bowers (Jardines y Jardinillos). The Queen's Gardens, properly so called, are nearer Cape Cruz, and are separated from the archipelago by an open sea thirty-five leagues broad. Columbus gave them the name they bear, in 1494, when, on his second voyage, he struggled during fiftyeight days with the winds and currents between the island of Pinos and the eastern cape of Cuba. He describes the islands of this archipelago as verdant, full of trees and pleasant* (verdes, llenos de arboledas, y graciosos).

[^417]A part of these so-styled gardens is indeed beautiful; the voyager sees the scene change every moment, and the verdure of some of the islands appears the more lovely from its contrast with chains of rocks, displaying only white and barren sands. The surface of these sands, heated by the rays of the sun, seems to be undulating like the sarface of a liquid. The contact of layers of air of unequal temperature, produces the most varied phenomena of suspension and mirage, from ten in the morning till four in the afternoon. Even in those desert places the sun animates the landscape, and gives mobility to the sandy plain, to the trunks of trees, and to the rocks that project into the sea like promontories. When the sun appears, these inert masses seem suspended in air; and on the neighbouring beach, the sands present the appearance of a sheet of water gently agitated by the winds. A train of clouds suffices to seat the trunks of trees and the suspended rocks again on the soil; to render the undulating surface of the plains motionless; and to dissipate the charm which the Arabian, Persian, and Hindoo poets have celebrated as "the sweet illusions of the solitary desert."

We doubled Cape Matahambre very slowly. The chronometer of Louis Berthoud having kept time accurately at the Havannah, I availed myself of this occasion to determine, on this and the following days, the positions of Cayo de Don Cristoval, Cayo Flamenco, Cayo de Diego Perez, and Cayo de Piedras. I also employed myself in examining the influence which the changes at the bottom of the sea produce on its temperature at the surface. Sheltered by so many islands, the surface is calm as a lake of fresh water, and the layers of different depths being distinct and separate, the smallest change indicated by the lead, acts on the thermometer. I was surprised to see that on the east of the little Cayo de Don Cristoval, the high banks are only distinguished by the milky colour of the water, like the bank of Vibora, south of Jamaica, and many other banks, the existence of which I ascertained by means of the thermometer. The bottom of the rock of Batabano is a sand composed of coral detritus; it nourishes sea-weeds which scarcely ever appear on the surface: the water, as I have already observed, is greenish; and the absence of the milky
tint is, no doubt, owing to the perfect calm which pervades those regions. Whenever the agitation is propagated to a certain depth, a very fine sand, or a mass of calcareous particles suspended in the water, renders it troubled and milky. There are shallows, however, which are distinguished neither by the colour, nor by the low temperature of the waters; and I believe that phenomenon depends on the nature of a hard and rocky bottom, destitute of sand and corals; on the form and declivity of the shelvings; the swiftness of the currents; and the absence of the propagation of motion towards the lower layers of the water. The cold frequently indicated by the thermometer, at the surface of the high banks, must be traced to the molecules of water which, owing to the rays of heat and the nocturnal cooling, fall from the surface to the bottom, and are stopped in their fall by the high banks; and also to the mingling of the layers of very deep water, that rise on the shelvings of the banks as on an inclined plane, to mix with the layers of the surface.

Notwithstanding the small size of our bark, and the boasted skill of our pilot, we often ran aground. The bottom being soft, there was no danger; but, nevertheless, at sun-set, near the pass of Don Cristoral, we preferred to lie at anchor. The first part of the night was beautifully serene: we saw an incalculable number of falling-stars, all following one direction, opposite to that from whence the wind blew in the low regions of the atmosphere. The most absolute solitude prevails in this spot, which, in the time of Columbus, was inhabited and frequented by great numbers of fishermen. The inhabitants of Cuba then employed a small fish to take the great sea-turtles; they fastened a long cord to the tail of the revès (the name given by the Spaniards to that species of Echeneis*). The

[^418]'fisher-fish,' formerly employed by the Cubans, by means of the flattened dise on his head, furnished with suckers, fixed himself on the shell of the sea-turtle, which is so common in the narrow and winding channels of the Jardinillos. "The revès," says Christopher Columbus, "will sooner suffer himself to be cut in pieces than let go the body to which he adheres." The Indians drew to the shore by the same cord, the fisher-fish and the turtle. When Gomara, and the learned secretary of the emperor Charles V., Peter Martyr d'Anghiera, promulgated in Europe this fact which they had learnt from the companions of Columbus, it was rece:ved as a traveller's tale. There is indeed an air of the marvellous in the recital of d'Anghiera, which begins in these words: "Non aliter ac nos canibus gallicis per æquora campi lepores insectamur, incolæ [Cubæ insulæ] venatorio pisce pisces alios capiebant." (Exactly as we follow hares with greyhounds in the fields, so do the natives [of Cuba] take fishes with other fish trained for that purposc). We now know, from the united testimony of Rogers, Dampier, and Commerson, that the artifice resorted to in the Jardinillos to catch turtles, is employed by the inhabitants of the eastern coast of Africa, near Cape Natal, at Mozambique, and at Madagascar. In Egypt, at San Domingo, and in the lakes of the valley of Mexico, the method practised for catching ducks was as follows:-men, whose heads were covered with great calabashes pierced with holes, hid themselves in the water, and seized the birds by the feet. The Chinese, from the remotest antiquity, have employed the cormorant, a bird of the pelican fumily, for fishing on the coast: rings are fixed round the bird's neck to prevent him from swallowing his prey, and fishing for himself. In the lowest degree of civilization, the sagacity of man is displayed in the stratagems of hunting and fishing: nations, who probably never had any communication with each other, furnish the most striking analogies in the means they employ in exercising their empire over animals.

I lost that part of my journal. It is doubtless the fear of danger that causes the remora not to loose his hold when he feels that he is pulled by a cord, or by the hand of man. The sucet spoken of by Columbus and Martin d'Anghiera, was probably the Echeueis naucrates and not the Echeneis remora.

Three days elapsed before we could emerge from this labyrinth of Jardines and Jardinillos. At night we lay at anchor; and in the day we visited those islands or chains of rocks which were most easily accessible. As we advanced eastward, the sea became less calm, and the position of the shoals was marked by water of a milky colour. On the boundary of a sort of gulf between Cayo Flamenco and Cayo de Piedras, we found that the temperature of the sea, at its surface, augmented suddenly from $23.5^{\circ}$ cent. to $25 \cdot 8^{\circ}$. The geologic constitution of the rocky islets that rise around the island of Pinos, fixed my attention the more earnestly, as I had always rather doubted of the existence of those huge masses of coral which are said to rise from the abyss of the Pacific to the surface of the water. It appeared to me more probable that these enormous masses had some primitive or volcanic rock for a basis, to which they adhered at small depths. The formation, partly compact and lithographic, partly bulbous, of the limestone of Guines, had followed us as far as Batabano. It is somewhat analogous to Jura limestone; and, judging from their external aspect, the Cayman Islands are composed of the same rock. It the mountains of the island of Pinos, which present at the same time (as it is said by the first historians of the conquest) the pineta and palmeta, be visible at the distance of twenty sea leagues, they must attain a height of more than five hundred toises: I have been assured that they also are formed of a limestone altogether similar to that of Guines. From these facts, I expected to find the same rock (Jura limestone) in the Jardinillos: but I saw, in the chain of rocks that rises generally five to six inches above the surface of the water, only a fragmentary rock, in which angular pieces of madrepores are cemented by quartzose sand. Sometimes the fragments form a mass of from one to two cubic feet, and the grains of quartz so disappear, that in several layers one might imagine that the polypi have remained on the spot. The total mass of this chain of rocks appears to me a limestone agglomerate, somewhat analogous to the earthy limestone of the peninsula of Araya, near Cumana, but of much more recent formation. The inequalities of this coral rock are covered by a detritus of shells and madrepores. Whatever rises above the surface
of the water is composed of broken pieces, cemented by carbonate of lime, in which grains of quartzose sand are set. Whether rocks formed by polypi still living are found at great depth below this fragmentary rock of coral ; or whether these polypi are raised on the Jura formation, are questions which I am unable to answer. Pilots believe that the sea diminishes in these latitudes, because they see the chain of rocks augment and rise, either by the earth which the waves heave up, or by successive agglutinations. It is not impossible that the enlarging of the channel of Bahama, by which the waters of the Gulf-stream issue, may cause, in the lapse of ages, a slight lowering of the waters south of Cuba, and erpecially in the gulf of Mexico, the centre of the great current which runs along the shores of the United States, and casts the fruits of tropical plants on the coast of Norway.* The configuration of the coast, the direction, the force, and the duration of certain winds and currents, the changes which the barometric heights undergo through the variable predominance of those winds, are causes, the concurrence of which may alter, in a long space of time, and in circumscribed limits of extent and height, the equilibrium of the seas. $\dagger$ When the coast is so low, that the level of the soil, at a league within the island, does not change to extent of a few inches, these swellings and diminution of the waters strike the imagination of the inhabitants.
The Cayo bonito (Pretty Rock), which we first visited, fully merits its name from the richness of its vegetation. Everything denotes that it has been long above the surface of the ocean; and the central part of the Cayo is not more depressed

[^419]than the banks. On a layer of sand and land shells, five to six inches thick, covered by a fragmentary madreporic rock, rises a forest of mangroves (Rhizophora). From their form and foliage, they might at a distance be mistaken for laurel trees. The Avicennia, the Batis, some small Euphorbia, and grasses, by the intertwining of their roots, fix the moving sands. But the characteristic distinction of the Flora of these coral islands, is the magnificent Tournefortia gnaphalioïdes of Jacquin, with silvered leaves, which we found here for the first time. This is a social plant, and is a shrub from four feet and a half to five feet high. Its flowers emit an agreeable perfume; and it is the ornament of Cayo Flamenco, Cayo Piedras, and perhaps of the greater part of the low lands of the Jardinillos. While we were employed in herborizing, our sailors were searching among the rocks for lobsters. Disappointed at not finding them, they avenged themselves by climbing on the mangroves and making a dreadful slaughter of the young alcatras, grouped in pairs in their nests. This name is given, in Spanish America, to the brown swan-tailed pelican of Buffon. With the want of foresight peculiar to the great pelagic birds, the alcatra builds his nest where several branches of trees unite together. We counted four or five nests on the same trunk of a mangrove. The young birds defended themselves valiantly with their enormous beaks, which are six or seven inches long; the old ones hovered over our heads, making hoarse and plaintive cries. Blood streamed from the tops of the trees, for the sailors were armed with great sticks and cutlasses (machetes). In vain we reproved them for this cruelty. Condemned to long obedience in the solitude of the seas, this class of men feel pleasure in exercising a cruel tyranny over animals, when occasion

* We gathered Cenchrus myosuroïdes, Euphorbia buxifolia, Batis maritima, Iresine obtusifolia, Tournefortia gnaphalioides, Diomedea glabrata, Cakile cubensis, Dolichos miniatus, Parthenium hysterophorus, \&cc. The last-named plant, which we had previouslyfound in the valley of Caracas and on the temperate table-lands of Mexico, between 470 and 900 toises high, covers the fields of the island of Cuba. It is used by the inhabitants for aromatic baths, and to drive away the fleas which are so numerous in tropical climates. At Cumana, the leaves of several species of cassia are employed, on account of their smell, against those annoying insects.
offers. The ground was covered with wounded birds struggling in death. At our arrival a profound calm prevailed in this secluded spot; now, everything seemed to say: Man has passed this way.

The sky was veiled with reddish vapours, which however dispersed in the direction of south-west; we hoped, but in vain, to discern the heights of the island of Pinos. Those spots have a charm in which most parts of the New World are wanting. They are associated with recollections of the greatest names of the Spanish monarchy-those of Christopher Columbus and of Hernan Cortez. It was on the southern coast of the island of Cuba, between the bay of Xagua and the island of Pinos, that the great Spanish Admiral, in his second royage, saw, with astonishment, "that mysterious king who spoke to his subjects only by signs, and that group of men who wore long white tunics, like the the monks of La Merced, whilst the rest of the people were naked." "Columbus in his fourth voyage found in the Jardinillos, great boats filled with Mexican Indians, and laden with the rich productions and merchandise of Yucatan." Misled by his ardent imagination, he thought he had heard from those navigators, " that they came from a country where the men were mounted on horses,* and

[^420]wore crowns of gold on their heads." "Catayo (China), the empire of the Great Khan, and the mouth of the Ganges," appeared to him so near, that he hoped soon to employ two Arabian interpreters, whom he had embarked at Cadiz, in going to America. Other remembrances of the island of Pinos, and the surrounding Gardens, are connected with the conquest of Mexico. When Hernan Cortès was preparing his great expedition, he was wrecked with his Nave Capitana, on one of the flats of the Jardinillos. For the space of five days he was believed to be lost, and the valiant Pedro de Alvarado sent (in November, 1518,) from the port of Carenas* (the Havannah) three vessels in search of him. In February, 1519, Cortès assembled his whole fleet near cape San Antonio, probably on the spot which still bears the name of Ensenada de Cortes, west of Batabano, and opposite to the island of Pinos. From thence, believing he should better escape the snares laid for him by the governor, Velasquez, he passed almost clandestinely to the coast of Mexico. Strange vicissitude of events! the empire of Montezuma was shaken by a handful of men who, from the western extremity of the island of Cuba, landed on the coast of Yucatan; and in our days, three centuries
terized by great simplicity, written by the discoverer of the New World : "Your Highness," says Columbus, "may believe me, the globe of the earth is far from being so great as the vulgar admit. I was seven years at your royal court, and during seven years was told that my enterprise was a folly. Now that I have opened the way, tailors ond shoemakers ask the privilege of going to discover new lands. Persecuted, forgotten as I am, I never think of Hispaniola and Paria without my eyes being filled with tears. I was twenty years in the service of your Highness; I have not a hair that is not white; and my body is enfeebled. Heaven and earth now mourn for me: all who have pity, truth, and justice, mourn for me (pianga adesso il cielo e pianga per me la terra; pianga per me chi ha carità, verità, giustizia)."-Let. rar. pp. 13, 19, 34, 37.

* At that period there were two settlements, one at Puerto de Carenas, in the ancient Indian province of the Havannah, and the other-the most considerable-in the Villa de San Cristoval de Cuba. These settlements were only united in 1519, when the Puerto de Carenas took the name of San Cristoval de la Habana. "Cortès," says Herrera, " pasó á la Villa de San Cristoval que á la sazon estaba en la costa del sur, y despues se pasó a la Habana." [Cortes proceeded to the town of San Cristoval, which at that time was on the sea-coast, and afterwards he repaired to the Havannah.]
later, Yucatan, now a part of the new confederation of the free states of Mexico, has nearly menaced with conquest the western coast of Cuba.

On the morning of the 11th March, we visited Cayo Flamenco. I found the latitude $21^{\circ} 59^{\prime} 39^{\prime \prime}$. The centre of this island is depressed, and only fourteen inches above the surface of the sea. The water here is brackish; while in other cayos it is quite fresh. The mariners of Cuba attribute this freshness of the water to the action of the sands in filtering sea-water, the same cause which is assigned for the freshness of the lagunes of Venice. But this supposition is not justified by anv chemical analogy. The cayos are composed of rocks, and not of sands, and their smallness renders it extremely improbable that the pluvial waters should unite in a permanent lake. Perhaps the fresh water of this chain of rocks comes from the neighbouring coast, from the mountains of Cuba, by the effect of hydrostatic pressure. This would prove a prolongation of the strata of Jura limestone below the sea, and a superposition of coral rock on that limestone.*

It is too general a prejudice, to consider every source of fresh or salt water to be merely a local phenomenon: currents of water circulate in the interior of lands between strata of rocks of a particular density or nature, at immense distances, like the floods that furrow the surface of the globe. The learned engineer, Don Francisco Le Maur, informed me, that in the bay of Xagua, half a degree east of the Jardinillos, there issue in the middle of the sea, springs of fresh water, two leagues and a half from the coast. These springs gush up with such force that they cause an agitation of the water often dangerous for small canoes. Vessels that are not going to Xagua sometimes take in water from these ocean springs, and the water is fresher and colder in proportion to the depth whence it is drawn. The manatis, guided by instinct, have discovered this region of fresh waters; and the fishermen who like the flesh of these

[^421]herbivorous animals,* find them in abundance in the open sea.

Half a mile east of Cayo Flamenco, we passed close to two rocks, on which the waves break furiously. They are the Piedras de Diego Perez (latitude $21^{\circ} 58^{\prime} 10^{\prime \prime \prime}$.) The temperature of the sea, at its surface, lowers at this point to $22 \cdot 6^{\circ}$ cent., the depth of the water being only about one fathom. In the evening we went on shore at Cayo de Piedras; two rocks connected together by breakers, and lying in the direction of N.N.W. to S.S.E. On these rocks which form the eastern extremity of the Jardinillos many vessels are lost, and they are almost destitute of shrubs, because shipwrecked crews cut them to make fire-signals. The Cayo de Piedras is extremely precipitous on the side near the sea; and towards the middle there is a small basin of fresh water. We found a block of madrepore in the rock, measuring upwards of three cubic feet. Doubtless this limestone formation, which at a distance resembles Jura limestone, is a fragmentary rock. It would be well if this chain of cayos which surrounds the island of Cuba, were examined by geologists with the view of determining what may be attributed to the animals which still work at the bottom of the sea, and what belongs to the real tertiary formations, the age of which may be traced back to the date of the coarse limestone abounding in remains of lithophite coral. In general, that which rises above the waters is only breccia, or aggregate of madreporic fragments cemented by carbonate of lime, broken shells, and sand. It is important to examine, in each of the cayos, on what this breccia reposes; whether it covers edfices of mollusca still living, or those secondary and tertiary rocks, which judging from the remains of coral they contain, seem to be the product of our days. The gypsum of the cayos oppo-

[^422]site San Juan de los Remedios, on the northern coast of the island of Cuba, merits great attention. Its age is doubtless more remote than historic times, and no geologist will believe that it is the work of the mollusca of our seas.

From the Cayo de Piedras we could faintly discern in the direction of E.N.E., the lofty mountains that rise beyond the bay of Xagua. During the night we again lay at anchor; and next day (12th March), having passed between the northern cape of the Cayo de Piedras and the island of Cuba, we entered a sea free from breakers. Its blue colour (a dark indigo tint), and the heightening of the temperature, proved how much the depth of the water had augmented. We tried, under favour of the variable winds on sea and shore, to steer eastward as far as the port of La Trinidad, so that we might be less opposed by the north-east winds which then prevail in the open sea, in making the passage to Carthagena, of which the meridian falls between Santiago de Cuba, and the bay of Guantanamo. Having passed the marshy coast of Camareos,* we arrived (latitude $21^{\circ} 50^{\prime}$ ) in the meridian of the entrance of the Bahia de Xagua. The longitude the chronometer gave me at this point was almost identical with that since published (in 1821) in the map of the Deposito hidrografico of Madrid.

The port of Xagua is one of the finest, but least frequented, of the island. "There cannot be another such in the world," is the remark of the Coronista major (Antonio de Herrera.) The surveys and plans of defence made by M. Le Maur, at the time of the commission of Count Jaruco, prove that the anchorage of Xagua merits the celebrity it acquired even in the first years of the conquest. The town now consists merely of a small group of houses and a fort (castillito.) On the east of Xagua, the mountains (Cerros de San Juan) near the coast, assume an aspect more and more majestic; not from their height, which does not seem to exceed three hundred toises, but from their steepness and general form. The coast, I was told, is so steep that a frigate may approach the mouth of the Rio Guaurabo.

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When the temperature of the air diminished at night to $\mathbf{2 8}^{\circ}$. and the wind blew from the land, it brought that delicious odour of flowers and honey which characterizes the shores of the island of Cuba.* We sailed along the coast keeping two or three miles distant from land. On the 13th March, a little before sunset, we were opposite the mouth of the Rio San Juan, so much dreaded by navigators on account of the innumerable quantity of mosquitos and zancudos which fill the atmosphere. It is like the opening of a ravine, in which vessels of heavy burden might enter, but that a shoal (placer) obstructs the passage. Some horary angles gave me the longitude $82^{\circ} 40^{\prime} 50^{\prime \prime}$, for this port, which is frequented by the smugglers of Jamaica and the corsairs of Providence Island. The mountains that command the port scarcely rise to 230 toises. I passed a great part of the night on deck. The coast was dreary and desolate. Not a light announced a fisherman's hut. There is no village between Batabano and Trinidad, a distance of fifty leagues; scarcely are there more than two or three corrales or farm yards, containing hogs or cows. Yet, in the time of Columbus, this territory was inhabited along the shore. When the ground is dug to make wells, or when torrents furrow the surface of the earth in floods, stone hatchets and copper utersils $\dagger$ are often discovered; these are remains of the ancient inhabitants of America.

At sunrise I requested the captain to heave the lead. There was no bottom to be found at sixty fathoms; and the ocean was warmer at its surface than anywhere else; it was

* Cuban wax, which is a very important object of trade, is produced by the bees of Europe (the species Apis, Latr.). Columbus says expressly, that in his time the inhabitants of Cuba did not collect wax. The great loaf of that substance which he found in the island in his first voyage, and presented to King Ferdinand in the celebrated audience of Barcelona, was afterwards ascertained to have been brought thither by Mexican barques from Yucatan. It is curious that the wax of melipones was the first production of Mexico that fell into the hands of the Spaniards, in the month of November, 1492.
$\dagger$ Doubtless the copper of Cuba. The abundance of this metal in its native state, would naturally induce the Indians of Cuba and Hayti to melt it. Columbus says that there were masses of native copper at Hayti, of the weight of six arrobas; and that the boats of Yucatan, which he met with on the eastern coast of Cuba, carried, among other Mexican merchandize, " crucibles to melt copper."
nt $26.8^{\circ}$; the temperature exceeded $4.2^{\circ}$ thett which we had found near the breakers of Diego Perez. At the distance of half a mile from the coast, the sea water was not more than $2.5^{\circ}$; we had no opportunity of sounding, but the depth of the water had no doubt diminished. On the 14th March, we entered the Rio Guaurabo, one of the two ports of Trinidad de Cuba, to put on shore the practico, or pilot of Batabano, who had steered us across the flats of the Jardinillos, though not withont causing us to run aground several times. We also hoped to find a packetboat (correo maritimo) in this port, which would take us to Carthagena. I landed towards the evening, and placed Borda's azimuth compass and the artificial horizon, on the shore, for the purpose of observing the passage of some stars by the meridian; but we had scarcely begun our preparations, when a party of small traders of the class called pulperos, who had dined on board a foreign ship recently arrived, invited us to accompany them to the town. These good people requested us mount two by two on the same horse ; and, as the heat was excessive, we accepted their offer. The distance from the mouth of the Rio Guaurabo to Trinidad, is nearly four miles, in a north-west direction. The road runs across a plain which seems as if it had been levelled by a long sojourn of the waters. It is covered with vegetation, to which the miraguama, a palmtree with silvered leaves (which we saw here for the first time), gives a peculiar character.* This fertile soil, although of tierra colorada, requires only to be tilled, and it would yield fruitful harvests. A very picturesque view opens westward on the Lomas of San Juan, a chain of calcareous mountains from 1800 to 2000 toises high, and very steep towards the south. Their bate and barren summits form sometimes round blocks; and here and there rise up in points

[^424]like horns,* a little inclined. Notwithstanding the great lowering of the temperature during the season of the Nortes, or north winds, snow never falls; and only a hoar-frost (escarcha) is seen on these mountains, as on those of Santiago. This absence of snow is difficult to be explained. In emerging from the forest, we perceived a curtain of hills, of which the southern slope is covered with houses; this is the town of Trinidad, founded in 1514, by the governor Diego Velasquez, on account of "the rich mines of gold" which were said to have been discovered in the little valley of Rio Arimao.t. The streets of Trinidad have all a rapid descent: there, as in most parts of Spanish America, it is complained that the Conquistadores chose very injudiciously the sites for new towns. $\ddagger$ At the northern extremity is the church of Nuestra Señora de la Popa, a celebrated place of pilgrimage. This point I found to be 700 feet above the level of the sea; it commands a magnificent view of the ocean, the two ports (Puerto Casilda and Boca Guaurabo), a forest of palm-trees, and the group of the lofty mountains of San Juan. We were received at the town of Trinidad with the kindest hospitality, by Señor Munoz, the Superintendent of the Real Hacienda. I made observations during a great part of the night, and found the latitude near the cathedral, by the Spica Virginis, a of the Centaur, and $\beta$ of the Southern Cross, under circumstances not equally favourable, to be $21^{\circ} 4 \mathrm{~S}^{\prime} 20^{\prime \prime}$. My chronometric longitude was $82^{\circ} 21^{\prime} 7^{\prime \prime}$. I was informed, at my second visit to the Havannah, in returning from Mexico, that this longitude was nearly identical with that obtained by the captain of

[^425]a frigate, Don Jose del Rio, who had long resided on that spot; but that he marked the latitude of the town at $21^{\circ} 42^{\prime} 40^{\prime \prime}$.
The Lieutenant-Governor (Teniente Governadore) of Trinidad, whose jurisdiction then extended to Villa Clara, Principe, and Santo Espiritu, was nephew to the celebrated astronomer Don Antonio Ulloa. He gave us a grand entertainment, at which we met some French emigrants from San Domingo, who had brought their talents and industry to Spanish America. The exportation of the sugar of Trinidad, by the registers of the custom-house, did not then exceed 4000 chests.

The advantage of having two ports is often discussed at Trinidad. The distance of the town from Puerto de Casilda and Puerto Guaurabo is nearly equal; yet the expense of transport is greatest in the former port. The Boca del Rio Guaurabo, defended by a new battery, furnishes safe anchorage, although less sheltered than that of Puerto Casilda. Vessels that draw little water, or are lightened to pass the bar, can go up the river and approach the town within a mile. The packet-boats (correos) that touch at Trinidad de Cuba, prefer, in general, the Rio Guaurabo, where they find safe anchorage without needing a pilot. The Puerto Casilda is more inclosed, and goes further back in-land; but cannot be entered without a pilot, on account of the breakers (arrecifes) and the Mulas and Mulattas. The great mole, constructed with wood, and very useful to commerce, was damaged in discharging pieces of artillery. It is entirely destroyed, and it was undecided whether it would be best to reconstruct it with masonry, according to the project of Don Luis de Bassecourt, or to open the bar of Guaurabo by dredging it. The great disadvantage of Puerto de Casilda is the want of fresh water, which vessels have to procure at the distance of a league.
We passed a very agreeable evening in the house of one of the richest inhabitants, Don Antonio Padron, where we found assembled at a tertulia all the good company of Trinidad. We were again struck with the gaiety and vivacity that distinguish the women of Cuba. These are happy gifts of nature, to which the refinements of European civilization might lend additional charms, but which, nevertheless, please
in their primitive simplicity. We quitted Trinidad on the night of the 15th. March. The municipality caused us to be conducted to the mouth of the Rio Guaurabo in a fine carriage lined with old crimson damask; and, to add to our confusion, an ecclesiastic, the poet of the place, habited in a suit of velvet notwithstanding the heat of the climate, celebrated, in a sonnet, our voyage to the Orinoco.

On the road leading to the port, we were forcibly struck by a spectacle which our stay of two years in the hottest part of the tropics might have rendered familiar to us; but previously I had nowhere seen such an innumerable quantity of phosphorescent insects.* The grass that overspread the ground, the branches and foliage of the trees, all shone with that reddish and moveable light, which varies in its intensity at the will of the animal by which it is produced. It seemed as though the starry firmament reposed on the savannah. In the hut of the poorest inhabitants of the country, fifteen cocuyos, placed in a calabash pierced with holes, afford sufficient light to search for anything during the night. To shake the calabash forcibly is all that is, necessary to excite the animal to increase the intensity of the luminous discs situated on each side of its body. The people of the country remark, with a simple truth of expression, that calabashes filled with cocuyos are lanterns always ready lighted. They are, in fact, only extinguished by the sickness or death of the insects, which are easily fed with alittle sugar-cane. A young woman at Trinidad de Cuba told us, that during a long and difficult passage from the main land, she always made use of the phosphorescence of the cocuyos, when she gave suck to her child at night; the captain of the ship would allow no other light on board; from the fear of corsairs.

As the breeze freshened in the direction of north-east, we sought to avoid the group of the Caymans, but the current drove us towards those islands. Sailing to S. $\frac{1}{4}$ S.E., we gradually lost sight of the palm-covered shore, the hills rising above the town of Trinidad, and the lofty mountains of the island of Cuba. There is something solemn in the aspect of land from which the voyager is departing, and which he sees sinking by degrees below the horizon of the sean
*. Cocuyo. (Elater noctilocne).

The interest of this impression was heightened at the period: to which I here advert; when Saint Domingo was the centre of great political agitations, and threatened to involve the other islands in one of those sanguinary struggles which reveal to man the ferocity of his nature. These threatened dangers were happily averted; the storm was appeased on the spot which gave it birth; and a free black population, far from troubling the peace of the neighbouring islands, has made some steps in the progress of civilization, and has promoted the establishment of good institutions. Porto Rico, Cuba, and Jamaica, with 370,000 whites and 885,000 men of colour, surround Hayti, where a population of 900,000 negros and mulattos have been emancipated by their own efforts. The negros, more inclined to cultivate alimentary plants than colonial productions, augment with a rapidity anly surpassed by the increase of the population of the United States.

## CHAPTER XXX.

Passage from Trinidad de Cuba to Rio Sinu.-Carthagena.-Air Volcanos of Turbaco.-Canal of Mahates.
. On the morning of the 17th of March, we came within sight, of the most eastern island of the group of the Lesser Caymans. Comparing the reckoning with the chronometric longitude, I ascertained that the currents had borne us in seventeen hours twenty miles westward. The island is called by the English pilots Cayman-brack, and by the Spanish pilots, Cayman chico oriental. It forms a rocky wall, bare and steep towards the south and south-east. The north and north-west part is low, sandy, and scantily covered with vege-. tation. The rock is broken into narrow horizontal ledges. From its whiteness and its proximity to the island of Cuba, Ir supposed it to be of Jura limestone. We approached the eastern extremity of Cayman-brack within the distance of 400 toises. The neighbouxing coast is not entirely free from danger and breakers; yet the temperature of the spa had not sensibly diminished at its surface. The chronometer of Louis Berthoud gave me $82^{\circ} 7^{\prime} 37^{\prime}$ for the longi-
tude of the eastern cape of Cayman-brack. The latitude reduced by the reckoning on the rhumbs of wind at the meridian observation, appeared to me to be $19^{\circ} 40^{\prime} 50^{\prime \prime}$.

As long as we were within sight of the rock of Caymanbrcck, sea-turtles of extraordinary dimensions swam round our vessel. The abundance of these animals led Columbus to give the whole group of the Caymans the name of Peñascales de las Tortugas, (rocks of the turtles.) Our sailors would have thrown themselves into the water to catch some of these animals; but the numerous sharks that accompany them, rendered the attempt too perilous. The sharks fixed their jaws on great iron hooks which were flung to them; these hooks were very sharp and (for want of anzuelos encandenados*) they were tied to cords: the sharks were in this manner drawn up half the length of their bodies; and we were surprised to see that those which had their mouths wounded and bleeding continued to seize the bait over and over again during several hours. $\dagger$ At the sight of these voracious fish, the sailors in a Spanish ressel always recollect the local fable of the coast of Venezuela, which describes the benediction of a bishop as having softened the habits of the sharks, which are everywhere else the dread of mariners. Do these wild sharks of the port of La Guayra specifically differ from those mhich are so formidable in the port of the Havannah? And do the former belong to the group of Emissoles with small sharp teeth, which Cuvier distinguishes from the Melandres, by the name of Musteli?

The wind freshened more and more from the south-east, as we advanced in the direction of Cape Negril and the

[^426]western extremity of the great bank of La Vibora. We were often forced to diverge from our course; and, on account of the extreme smallness of our vessel, we were almost constantly under water. On the 18th March, at noon, we found ourselves in latitude $18^{\circ} 17^{\prime} 40^{\prime \prime}$, and in $81^{\circ} 50^{\prime}$ longitude. The horizon, to the height of $50^{\circ}$, was covered with those reddish vapours so common within the tropics, and which never seem to affect the hygrometer at the surface of the globe. We passed fifty miles west of Cape Negril on the south, nearly at the point where several charts indicate an insulated flat, of which the position is similar to that of Sancho Pardo, opposite to Cape San Antonio de Cuba. We saw no change in the bottom. It appears that the rocky shoal at a depth of four fathoms, near Cape Negril, has no more existence than the rock (cascabel) itself, long believed to mark the western extremity of La Vibora (Pedro Bank, Portland Rock, or la Sola), marking the eastern extremity. On the 19th of March, at four in the afternoon, the muddy colour of the sea denoted that we had reached that part of the bank of La Vibora, where we no longer find fifteen, and indeed scarcely nine or ten, fathoms of water. Our chronometric longitude was $81^{\circ} 3^{\prime}$; and our latitude probably below $17^{\circ}$. I was surprised that, at the noon observation, at $17^{\circ} 7^{\prime}$ of latitude, we yet perceived no change in the colour of the water. Spanish vessels going from Batabano or Trinidad de Cuba to Carthagena, usually pass over the bank of La Vibora, on its western side, at between fifteen and sixteen fathoms water. The dangers of the breakers begin only beyond the meridian $80^{\circ} 4.5^{\prime}$ west longitude. In passing along the bank on its southern limit, as pilots often do in proceeding from Cumana or other parts of the mainland, to the Great Cayman or Cape San Antonio, thev need not ascend along the rocks, above $16^{\circ} 47^{\prime}$ latitude. Fortunately the currents run on the whole bank to S.W.

Considering La Vibora not as a submerged land, but as a heaved-up part of the surface of the globe, which has not reached the level of the sea, we are struck at finding on this great submarine island, as on the neighbouring land of Jamaica and Cuba, the loftiest heights towards its eastern boundary. In that direction are situated Portland Rock,

Pedro Keys, and South Key, all surrounded by dangerous breakers. The depth is six or eight fathoms; but, in advancing to the middle of the bank, along the line of the summit, first towards the west and then towards the northwest, the depth becomes successively ten, twelve, sixteen, and nineteen fathoms. When we survey on the map the proximity of the high lands of San Domingo, Cuba, and Jamaica, in the neighbourhood of the Windward Channel, the position of the island of Navaza, and the bank of Hormigas, between Capes Tiburon and Morant; when we trace that chain of successive breakers, from the Vibora, by Baxo Nuevo, Serranilla, and Quita Sueño, as far as the Mosquito Sound, we cannot but recognize in this system of islands and shoals; the almost-continued line of a heaved-up ridge, rumning from. N.E. to S.W. This ridge, and the old dyke, which link, by the rock of Sancho Pardo, Cape San Antonio. to the peninsula of Yucatan, divide the great sea of the West Indies into three partial basins; similar to those. observed in the Mediterranean.

The colour of the troubled waters on the shoal of La Vibora, has not a milky appearance like the waters in the Jardinillos, and on the bank of Bahama; but it is of a dirty grey colour. The striking differences of tint on the bank of Newfoundland, in the archipelago of the Bahama Islands and on La Vibora, the variable quantities of earthy matter suspended in the more or less troubled waters of the soundings, may all be the effects of the variable absorption of the rays of light, contributing to modify to a certain point the temperature of the sea. Where the shoals are $8^{\circ}$ to $10^{\circ}$ colder at their surface than the surrounding sea, it cannot be surprising that they should produce a local change of climate. A great mass, of very cold water, as on the bank of Newfoundland, in the current of the Perurian shore (between the port of Callao and Punta Pariña*), or in the African current near Cape Verd, have necessarily an influence on the atmosphere that covers the sea, and on

[^427]the climate of the neighbouring land; but it is less easy to conceive that those slight changes of temperature (for instance, a centesimal degree on the bank of La Vibora), can impart a peculiar character to the atmosphere of the shoals. May not these submaxine islands act upon the formation and accumulation of the vesicular vapours in some other way than by caoling the waters of the surface?

Quitting the bank of La Vibora, we passed between the Baxo Nuevo, and the light-house of Cambay; and on the 22nd March, we passed more than thirty leagues to westward of El Roncador (The Snorer), a name which this shoal has received from the pilots, who assert, on the authority of ancient traditious, that a sound like snoring is heard from. afar. If such a sound be really heard, it arises, no doubt, from a periodical issuing of air compressed by the waters in a rocky cavern. I have observed the same phenomenon on several coasts, for instance, on the promontories of Teneriffe, in the limestones of the Havannah,* and in the granite of Lower Peru, between Truxillo and Lima. A project was formed at the Canary Islands, for placing a machine at the issue of the compressed air, and allowing the sea to act as an impelling force. While the autumnal equinox* is everywhere. dreaded in the sea of the West Indies (except on the coast of Cumana and Caracas), the spring equinox produces no effect on the tranquillity of those tropical regions: a phenomenon almost the inverse of that observable in high latitudes. Since we had quitted La Vibora, the weather had been remarkably fine; the colour of the sea was indigo-blue, and sometimes violet, owing to the quantity of medusp and eggs of fish (purga de mar) which covered it. Its surfacewas gently agitated. The thermometer kept up, in the shade, from $26^{\circ}$ to $27^{\prime \prime}$; not a cloud arose on the horizon, although the wind was constantly north, or N.N.W. I know, not whother to attribute to this wind, which cools the higher layers of the atmosphere, and there produces icy crystals, the halos which were formed round the moon two nights successively. The halos were of small dimensions, $45^{\circ}$ diameter. I never had an opportunity of seeing and measuring any $\dagger$ of which the diameter had at-

* Called by thes Spaniskr sailors "Ed Cordonazo do San Francisco."
+ In Captain Parry's first voyage, halos were measured round the sun
tained $90^{\circ}$. The disappearance of one of those lunar halos was followed by the formation of a great black cloud, from which fell some drops of rain; but the sky soon resumed its fixed serenity, and we saw a long series of falling-stars and bolides, which moved in one direction, and contrary to that of the wind of the lower strata.

On the 23rd March, a comparison of the reckoning with the chronometric longitude, indicated the force of a current bearing towards W.S. W. Its swiftness, in the parallel of $17^{\circ}$, was twenty to twenty-two miles in twentyfour hours. I found the temperature of the sea somewhat diminished; in latitude $12^{\circ} 35^{\prime}$, it was only $25.9^{\circ}$ (air $27 \cdot 0^{\circ}$ ). During the whole day the firmament exhibited a spectacle which was thought remarkable even by the sailors, and which I had observed on a previous occasion (June 13th, 1799). There was a total absence of clouds, even of those light vapours called 'dry;' yet the sun coloured, with a fine rosy tint, the air and the horizon of the sea. Towards night, the sea was covered with great bluish clouds; and when they disappeared, we saw, at an immense height, fleecy clouds in regular spaces, and ranged in convergent bands. Their direction was from N.N.W. to S.S.E., or more exactly, N. $20^{\circ}$ W., consequently contrary to the direction of the magnetic meridian.

On the 24th March, we entered the gulf which is bounded on the east by the coast of Santa Marta, and on the west by Costa Rica; for the mouth of the Magdalena and that of the Rio San Juan de Nicaragua, are on the same parallel, nearly $11^{\circ}$ lat. The proximity of the Pacific Ocean, the configuration of the neighbouring lands, the smallness of the isthmus of Panama, the lowering of the soil between the gulf of Papagayo and the port of San Juan de Nicaragua, the vicinity of the snowy mountains of Santa Marta, and many other circumstances too numerous to mention, combine to create a peculiar climate in this gulf. The atmosphere is agitated by violent gales, known in winter by the name of the brizotes de Santa Marta. When the wind abates, the currents bear to N.E., and the conflict between the slight breezes (from E. and N.E.) and moon, of which the rays were $22 \frac{1}{2}^{\circ} ; 22^{\circ} 32^{\prime} ; 38^{\circ} ; 46^{\circ}$. (North-west Passage, 1821.)
and the current, renders the sea rough and agitated. In calm weather, the vessels going from Carthagena to Rio Sinu, at the mouth of the Atrato and at Portobello, are impeded in their course by the currents of the coast. The heavy or brizote winds, on the contrary, govern the movement of the waters, which they impel in an opposite direction, towards W.S.W. It is the latter movement which Major Rennell, in his great hydrographic work, calls drift ; and he distinguishes it from real currents, which are not owing to the local action of the wind, but to differences of level in the surface of the ocean; to the rising and accumulation of waters in very distant latitudes. The observations which I have collected on the force and direction of the winds, on the temperature and rapidity of the currents, on the influence of the seasons, or the variable declination of the sun, have thrown some light on the complicated system of those pelagic floods that furrow the surface of the ocean : but it is less easy to conceive the causes of the change in the movement of the waters at the same season and with the same wind. Why is the Gulf-stream sometimes borne on the coast of Florida, sometimes on the border of the shoal of Bahama? Why do the waters flow, for the space of whole weeks, from the Havannah to Matanzas, and (to cite an example of the corriente por arriba, which is sometimes observed in the most eastern part of the main land during the prevalence of gentle winds) from La Guayra to Cape Codera and Cumana?
As we advanced, on the 25th of March, towards the coast of Darien, the north-east wind increased with violence. We might have imagined ourselves transported to another climate. The sea became very rough during the night, yet the temperature of the water kept up (from lat. $10^{\circ} 30^{\prime}$, to $9^{\circ} 47^{\prime}$ ) at $25.8^{\circ}$. We perceived, at sunrise, a part of the archipelago* of Saint Bernard, which closes the gulf of Morrosquillo on the north. A clear spot between the clouds

[^428]enabled me to take the horary angles. The chronometer, at the little island of Mucara, gave lon. $78^{\circ} 13^{\prime} 54^{\prime \prime}$. We passed on the southern extremity of the Placer de San Bernardo. The waters were milky, although a sounding of twenty-five fathoms did not indicate the bottom; the cooling of the water was not felt, doubtless owing to the rapidity of the current. Above the archipelago of Saint Bernard and Cape Boqueron, we saw in the distance the mountains of Tigua. The stormy weather, and the difficulty of going up against the wind, induced the captain of our frail vessel to seek shelter in the Rio Sinu, or rather, near the Punta del Zapote, situated on the eastern bank of the Ensenada de Cispata, into which flows the river Sinu or the Zenu of the early Conquistadores. It rained with violence, and I availed myself of that occasion to measure the temperature of the rain-water: it was $26.3^{\circ}$, while the thermometer in the air kept up, in a place where the bulb was not wet, at $24: 8^{\circ}$. This result differed much from that we had obtained at Cumana, where the rain-water was often a degree colder than the air.*

[^429]Our passage from the island of Cuba to the coast of South Alnerica terminated at the mouth of the Rio Sinu, and it occupied sixteen days. The roadstead near the Punta del Zapote afforded very bad anchorage; and in a rough sea, and with a violent wind, we found some difficulty in reaching the coast in our canoe. Everything denoted that we had entered a wild region, rarely visited by strangers. A few scattered houses form the village of Zapote: we found a great number of mariners assembled under a sort of shed, all men of colour, who had descended the Rio Sinu in their barks, to carry maize, bananas, poultry, and other provisions, to the port of Carthagena. These barks, which are from fifty to eighty feet long, belong for the most part to the planters (haciendados) of Lorica. 'The value of their largest freight amounts to about 2000 piastres. These boats are flat-bottomed, and cannot keep at sea when it is very rough. The breezes from the N.E. had, during ten days, blown with violence on the coast, while, in the open sea, as far as $10^{\circ}$ lat., we had only had slight gales, and a constantly calm sea. In the aërial, as in the pelagic currents, some layers of fluids move with extreme swiftness, while others near them remain almost motionless. The zambos of the Rio Sinu wearied us with idle questions respecting the purpose of our voyage, our books, and the use of our instruments: they regarded us with mistrust; and to escape from their importunate curiosity, we went to herborize in the forest, although it rained. They had endeavoured, as usual, to alarm us by stories of boas (traga-venado), vipers, and the attacks of jaguars; but during a long residence among the Chayma Indians of the Orinoco, we were habituated to these exaggerations, which arise less from the credulity of the natives, than from the pleasure they take in tormenting the whites. Quitting the coast of Zapote, covered with mangroves,* we entered a forest remarkable for a great variety of palm-trees. We saw the trunks of the Corozo del Sinu $\dagger$ pressed against each other, which

## enormous size of the drops of rain that fall at Cumana, Carthagena, and

 Guayaquil.* Rhizophora mangle.
+ In Spanish Auierka, palm-trees with leaves the most different in kind and species, are called Corozo: the Corozo del Sinu, with a short,
formed heretofore our species Alfonsia, yielding oil in abundance; the Cocos butyracea, called here palma dolce or palma real, and very different from the palma real of the island of Cuba; the palma amarya, with fan-leaves that serve to cover the roofs of houses, and the latta," resembling the small piritu palm-tree of the Orinoco. This variety of palm-trees was remarked by the first Conquistadores. $\dagger$ The Alfonsia, or rather the species of Elais, which we had nowhere else seen, is only six feet high, with a very large trunk; and the fecundity of its spathes is such that they contain more than 200,000 flowers. Although a great number of those flowers (one tree bearing 600,000 at the same time) never come to maturity, $\ddagger$ the soil remains covered with a thick layer of fruits. We often made a similar observation under the shade of the mauritia palm-tree, the Cocos butyracea, the Seje, and the Pihiguao of the Atabapo. No other family of arborescent plants is so prolific in the development of the organs of flowering. The almond of the Corozo del. Sinu is peeled in the water. The thick layer of oil that swims in the water is purified by boiling, and yields the butter of Corozo (manteca de Corozo), which is thicker than the oil of the cocoa-tree, and serves to light churches and houses. The palm-trees of the section of Cocoinies of Mr . Brown, are the olive-trees of the tropical regions. As
thick, glossy trunk, is the Elæis melanococca of Martius (Palm., p. 64, tab. xxxiii., lv.). I cannot believe it to be identical with the Elxis guineensis (Herbal of Congo River, p. 37) since it vegetates spontaneously in the forests of the Rio Sinu. The Corozo of Caripe is slender, small, and covered with thorns; it approaches the Cocos aculeata of Jacquin. The Corozs de los Marinos of the valley of Cauca, one of the tallest palmtrees, is the Cocus butyracea of Linnæus.
* Perhaps of the species of Aiphanes.
$\dagger$ Pedro de Cieça de Leon, a native of Seville, who travelled in 1531, at the age of thirteen years, in the countries I have described, observes that "Las tierras comarcanas del Rio Cenù y del Golfo de Uraba estan llena de unos palmares muy grandes y espessos, que son unos arboles gruessos, y llevan unas ramas cono palma de datiles." [The lands adjacent to the Rio Cenu and the Gulf of Uraba, are full of very tall, spreading palmtrees. They are of vast size, and are branched like the date-palm.] See La Cronica del Peru nuevamenta escrita (Antwerp, 1554), pp. 21, 204.
$\ddagger$ I have carefully counted how many flowers are contained in a square inch on each amentum, from $\mathbf{1 0 0}$ to $\mathbf{1 2 0}$ of which arc found united in one spathe.
we advanced in the forest, we began to find little pathways, looking as though they had been recently cleared out by the hatchet. Their windings displayed a great number of new plants: Mougeotia mollis, Nelsonia albicans, Melampodium paludosum, Jonidium anomalum, Teucrium palustre, Gomphia lucens, and a new kind of Composées, the Spiracantha cornifolia. A fine Pancratium embalmed the air in the humid spots, and almost made us forget that those gloomy and marshy forests are highly dangerous to health.

After an hour's walk, we found, in a cleared spot, several inhabitants employed in collecting palm-tree wine. The dark tint of the zambos formed a strong contrast with the appearance of a little man with light hair and a pale complexion, who seemed to take no share in the labour. I thought at first that he was a sailor who had escaped from some North American vessel; but I was soon undeceived. This fair-complexioned man was my countryman, born on the coast of the Baltic ; he had served in the Danish navy, and had lived for several years in the upper part of the Rio Sinu, near Santa Cruz de Lorica. He had come, to use the words of the loungers of the country "para ver tierras, $\mathbf{y}$ pasear, no mas"-(" to see other lands, and to roam about: nothing else.") The sight of a man who could speak to him of his country, seemed to have no attraction for him; and, as he had almost forgotten German without being able to express himself clearly in Spanish, our conversation was not very animated. During the five years of my travels in Spanish America, I found only two opportunities of speaking my native language. The first Prussian I met with was a sailor from Memel, who served on board a ship from Halifax, and who refused to make himself known till after he had fired some musket-shot at our boat. The second, the man we met at the Rio Sinu, was very amicably disposed. Without answering my questions, he continued repeating, with a smile, "that the country was hot and humid; that the houses in the town of Pomerania were finer than those of Santa Cruz de Lorica; and that, if we remained in the forest, we should have the tertian fever (calentura) from which he had long suffered." We had some difficulty in testifying our gratitude to this good man for his kind advice; for according to his somewhat aristocratic princiVOL. III.
ples, a white man, were he barefooted, should never accept money "in the presence of those vile coloured people!" (gente parda). Less disdainful than our European countryman, we saluted politely the group of men of colour, who were employed in drawing off into large calabashes, or fruits of the Crescentia cujete, the palm-tree wine, from the trunks of felled trees. We asked them to explain to us this operation, which we had already seen practised in the missions of the Cataracts. The vine of the country is the palma dolce, the Cocos butyracea, which, near Malgar, in the valley of the Magdalena, is called "the wine palm-tree," and here, on account of its majestic height, "the royal palm-tree." After having thrown down the trunk, which diminishes but little towards the top, they make just, below the point whence the leaves (fronds) and spathes issue, an excavation in the ligneous part, eighteen inches long, eight broad, and six in depth. They work in the hollow of the tree, as though they were making a canoe; and three days afterwards this cavity is found filled with a yellowish-white juice, very limpid, with a sweet and vinous flavour. The fermentation appears to commence as soon as the trunk falls, but the vessels preserve their vitality; for we saw that the sap flowed even when the summit of the palm-tree (that part whence the leaves sprout out) is a foot higher than the lower end, near the roots. The sap continues to mount as in the arborescent Euphorbia recently cut. During eighteen to twenty days, the palm-tree wine is daily collected; the last is less sweet, but more alcoholic and more highly esteemed. One tree yields as much as eighteen bottles of sap, each bottle containing forty-two cubic inches. The natives affirm that the flowing is more abundant, when the petioles of the leaves, which remain fixed to the trunk, are burnt.

The great humidity and thickness of the forest forced us to retrace our steps, and to gain the shore before sunset. In several places, the compact limestone rock, probably of tertiary formation, is visible. A thick laver of clay and mould rendered observation difficult ; but a shelf of carburetted and shining slate seemed to me to indicate the presence of more ancient formations. It has been affirmed that coal is to be found on the banks of the Sinu. We met with Zambos,
carrying on their shoulders the cylinders of palmetto, improperly called "the cabbage palm," three feet long, and five to six feet thick. The stem of the palm-tree has been for ages an esteemed article of food in those countries. I believe it to be wholesome, although historians relate that, when Alonso Lopez de Ayala was governor of Uraba, several Spaniards died, after having eaten immoderately of the palmetto, and at the same time drinking a great quantity of water. In comparing the herbaceous and nourishing fibres of the young undereloped leaves of the palm-trees, with the sago of the Mauritia, of which the Indians make bread, similar to that of the root of the Jatropha manihot, we involuntarily recallect the striking analogy which modern chemistry has proved to exist between ligneous matter and the amylaceous fecula. We stopped on the shore to colleet lichens, opegraphas, and a great number of mosses (Boletus, Hydnum, Helvela, Thelephora) that were attached to the mangroves, and there, to my great surprise, vegetating, although moistened by the sea-water.

Before I quit this coast, so seldom visited by travellers, and described by no modern voyager, I may here offer some information which I acquired during my stay at Carthagena. The Rio Sinu, in its upper course, approaches the tributary streams of the Atrato, which, to the auriferous and platiniferous province of Choco, is of the same importance as the Magdalena to Cundinamarca, or the Rio Cauca to the provinces of Antioquia and Popayan. The three great rivers here mentioned have heretofore been the only commercial routes, I might almost add, the only channels of communication, for the inhabitants. The Rio Atrato receives, at twelve leagues distance from its mouth, the Rio Sucio, on the east; the Indian village of San Antonio is situated on its banks. Proceeding upward beyond the Rio Pabarando, you arrive in the valley of Sinu. After several fruitless attempts on the part of the Archbishop Gongora to establish colonies in Darien del Norte and on the eastern coast of the gulf of Uraba, the Viceroy Espeleta recommended the Spanish Government to fix its whole attention on the Rio Sinu; to destrov the colony of Cayman ; to fix the planters in the Spanish village of San Bernardo del Viento, in the jurisdiction of Lorica; and from that post, whieh is
the most westerly, to push forward the peaceful conquests of agriculture and civilization towards the banks of the Pabarando, the Rio Sucio, and the Atrato.* The number of independent Indians who inhabit the lands between Uraba, Rio Atrato, Rıo Sucio, and Rio Sinu, was, according to a census made in 1760, at least 1800 . They were distri-

* I will here state some facts which I obtained from official documents during my stay at Carthagena, and which have not yet been published. In the sixteenth and seventeenth centuries, the name of Darien was given vaguely to the whole coast extending from the Rio Damaquiel to the Punta de San Blas, on $24^{\circ}$ of longitude. The cruelties exercised by Pedrarias Davila rendered almost inaccessible to the Spaniards a country which was one of the first they had colonized. The Indians (Dariens and Cunas-Cunas) remained masters of the coast, as they still are at Poyais, in the land of the Mosquitos. Some Scotchmen formed, in 1698, the settlements of New Caledonia, New Edinburgh, and Scotch Port, in the most eastern part of the isthmus, a little west of Punta Carreto. They were soon driven away by the Spaniards; but, as the latter occupied nc part of the coast, the Indians continued their attacks against Choco's boats, which from time to time descended the Rio Atrato. The sanguinary expedition of Don Manuel de Aldarete, in 1729, served only to augment the resentment of the natives. A settlement for the cultivation of the cocoa-tree, attempted in the territory of Urabia, in 1540, by some French planters, under the protection of the Spanish Government, had no durable success; and the court, excited by the reports of the archbishop-viceroy, Gongora, ordered, by the cedule of the 15th August, 1783, "either the conversion and conquest, or the destraction (reduccion ò extincion) of the Indians of Darien." This order, worthy of another age, was executed by Don Antonio de Arebalo: he experienced little resistance, and formed, in 1785, the four settlements and forts of Cayman on the eastern coast of the Gulf of Urabia, Concepcion, Carolina, and Mandinga. The Lele, or high-priest of Mandinga, took an oath of fidelity to the King of Spain; but, in 1786, the war with the Darien Indians recommenced, and was terminated by a treaty concluded July 27th, 1787, between the archbishopviceroy and the cacique Bernardo. The forts and new colonies, which figured only on the maps sent to Madrid, augmented the debt of the treasury of Santa.Fé de Bogota, in 1789, to the sum of $1,200,000$ piastres. The viceroy, Gil Lemos, wiser than his predecessor, obtained permission from the court to abandon Carolina, Concepcion, and Mandinga. The settlement of Cayman only was preserved, on account of the navigation of the Atrato, and it was declared free, under the government of the archbishop-viceroy: it was proposed to transfer this settlement to a more healthy spot, that of Uraba; but lieutenant-general Don Antonio Arebalo, having proved that the expense of this removal would amount to the sum of 40,000 piastres, the fort of Cayman was also destroyed, by order of the viceroy Espeleta, in 1791, and the planters were compelled to join those of the village of San Bernardo.
buted in three small villages, Suraba, Toanequi, and Jaraguia. This population was computed, at the period when I travelled there, to be 3000 . The natives, comprehended in the general name of Caymans, live at peace with the inhabitants of San Bernardo del Viento ( $p u e \overline{b l o ~ d e ~ E s p a n ̃ o l e s), ~ s i t u a t e d ~}$ on the western bank of the Rio Sinu, lower than San Nicolas de Zispata, and near the mouth of the river. These people have not the ferocity of the Darien and Cunas Indians, on the left bank of the Atrato; who often attack the boats trading with the town of Quidbo in the Choco; they also make incursions on the territory of Uraba, in the months of June and November, to collect the fruit of the cacao-trees. The cacao of Uraba is of excellent quality; and the Darien Indians sometimes come to sell it, with other productions, to the inhabitants of Rio Sinu, entering the valley of that river by one of its tributary streams, the Jaraguai.

It cannot be doubted that the Gulf of Darien was considered, at the beginning of the sixteenth century, as a nook in the country of the Caribs. The word Caribana is still preserved in the name of the eastern cape of that gulf. We know nothing of the languages of the Darien, Cunas, and Cayman Indians : and we know not whether Carib or Arowak words are found in their idioms; but it is certain, notwithstanding the testimony of Anghiera on the identity of the race of the Caribs of the Lesser Antilles and the Indians of Uraba, that Pedro de Cieça, who lived so long among the latter, never calls them Caribs nor cannibals. He describes the race of that tribe as being naked. with long hair, and going to the neighbouring countries to trade; and says the women are cleanly, well dressed, and extremely engaging (amorosas y galanas). "I have not seen," adds the Conquistador, "any women more beautiful" in all the Indian

[^430]lands I have visited: they have one fault, however, that of having too frequent intercourse with the devil."

The Rio Sinu, owing to its position and its fertility, is of the highest importance for provisioning Carthagena. In time of war, the enemy usually stationed their ships between the Morro de Tigua and the Boca de Matunilla, to intercept barques laden with provisions. In that station, they were, however, sometimes exposed to the attack of the gun-boats of Carthagena: these gun-boats can pass through the channel of Pasacaballos, which, near Saint Anne, separates the isle of Baru from the continent. Lorica has, since the sisteenth century, been the principal town of Rio Sinu; but its population, which, in 1778, under the government of Don Juan Diaz Pimienta, amounted to 4000 souls, has considerably diminished, because nothing has been done to secure the town from inundations and the deleterious miasmata they produce.
a question of morals than of race, and the denomination of Caribs is altogether avoided. Cieça asserts that the natives of the valley of Nore seized the women of neighbouring tribes, in order first to devour the children who were born of the union with foreign wives, and then the women themselves. Foreseeing that this horrible depravity would not be believed, although it had been observed by Columbus in the West Indies, he cites the testimony of Juan de Vadillo, who had observed the same facts, and who was still living in 1554, when the Cronica del Peru appeared in Dutch. With respect to the etymology of the word cannibal, it seems to me entirely cleared up by the discovery of the journal kept by Columbus during his first voyage of discovery, and of which Bartholomew de las Casas has left us an abridged copy. "Dice mas el Almirante que en las islas passadas estaban con gran temor de carib: y en algunas los llamaban caniba; però en la Española carib y son gente arriscada, pues andan por todas estas islas y comen la gente que pueden haber." [And the Admiral moreover says that in the islands they passed, great apprehension was entertained on account of the caribs. Some call them canibas; but in Spanish they are called caribs. They are a very bold people, and they travel about these islands, and devour all the persens whom they capture.]-(Navarete, tom. i, p. 135.) In this primitive form of words, it is easy to perceive that the permutation of the letters $r$ and $n$, resulting from the imperfection of the organs in some nations, might change carib into canib, or caniba. Geraldini, who, according to the tendency of that age, sought, like Cardinal Bembo, to latinize all barbarous denominations, recognizes, in the Cannibals, the manners of dogs (canes), just as St. Louis desired to send the Tartars "ad suas tar. tareas sedes unde exierint."

The gold-washings of the Rio Sinu, heretafore so important, above all, between its source and the village of San Geronimo, have almost entirely ceased, as well as those of Cienega de Tolu, Uraba, and all the rivers descending from the mountains of Abibé. "The Darien and the Zenu," says the bachelor Enciso, in his geographical work, published at the beginning of the sixteenth century, "is a country so rich in gold pepites, that, in the running waters, that metal can be fished with nets." Excited by these narratives, the governor Pedrarias sent bis lieutenant, Francisco Becerra, in 1515, to the Rio Sinu. This expedition was most unfortunate, for Becerra and his troop were massacred by the natives, of whom the Spaniards, according to the custom of the time, had carried away great numbers to be sold as slaves in the West Indies. The province of Antioquia now furnishes, in its auriferous veins, a vast field for mining speculations; but it might be well worth while to relinquish gold-washings for the cultivation of colonial productions, in the fertile lands of Sinu, the Rio Damaquiel, the Uraba, and the Darien del Norte ; above all, that of cacao, which is of a superior quality. The proximity of the port of Carthagena would also render the neglected cultivation of cinchona an object of great importance to European trade. That precious tree vegetates at the source of the Rio Sinu, as in the mountains of Abibé and Maria. The real febrifuge cinchona, with a hairy corolla, is nowhere else found so near the coast, if we except the Sierra Nevada of Santa Marta.

The Rio Sinu and the Gulf of Darien were not visited by Columbus. The most eastern point at which that great man touched land, on the 26th November, 1503, is the Puerto de Retreto, now called Punta de Escribanos, near the Punta of San Blas, in the isthmus of Panama. Two years previously, Rodrigo de Bastidas and Alanso de Ojeda, accompanied by Amerigo Vespucci, had discovered the whole coast of the main land, from the Gulf of Maracaybo as far as the Puerto de Retreto. Having often had occasion in the preceding volumes to speak of New Andalusia, I may here mention that I found that denomination, for the first time, in the convention made by Alonso de Ojeda with the Conquistador Diego de Sicuessa, a powerful man, say the historians of bis time, " because he was a flattering courtier and a wit."

In 1508, all the country from the Cabo de la Vela to the Gulf of Uraba. where the Castillo del Oro begins, was called New Andalusia, a name since restricted to the province of Cumana.

A fortunate chance led me to see, during the course of my travels, the two extremities of the main land, the mountainous and verdant coast of Paria, which Columbus supposes to have been the cradle of the human race, and the low and humid coast extending from the mouth of the Sinu towards the Gulf of Darien. The comparison of these scenes, which have again relapsed into a savage state, confirms what I have elsewhere advanced relative to the strange and sometimes retrograde nature of civilization in America. On one side, the coast of Paria, the islands of Cubagua and Marguerita; on the other, the Gulf of Uraba and Darien, received the first Spanish colonists. Gold and pearls, which were there found in abundance, because from time immemorial they had been accumulated in the hands of the natives, gave those countries a popular celebrity, from the beginning of the sixteenth century. At Seville, 'Toledo, Pisa, Genoa, and Antwerp, those countries were viewed like the realms of "Ormuz and of Ind." The pontiffs of Rome mentioned them in their bulls; and Bembo has celebrated them in those historical pages which add lustre to the glory of Venice.

At the close of the fifteenth, and the beginning of the sixteenth century, Europe saw, in those parts of the New World discovered by Columbus, Ojeda, Vespucci, and Rodrigo de Bastidas, only the advanced capes of the vast territories of India and eastern Asia. The immense wealth of those territories in gold, diamonds, pearls, and spices, had been vaunted in the narratives of Benjamin de Tudela, Rubruquis, Marco Polo, and Mandeville. Columbus, whose imagination was excited by these narrations, caused a deposition to be made before a notary, on the 12th of June, 1494, in which sixty of his companions, pilots, sailors, and passengers, certified upon oath, that the southern coast of Cuba was a part of the continent of India. The description of the treasures of Cathay and Cipango, of "the celestial town" of Quinsay and the province of Mango, which had fired the admiral's ambition in early life, pursued him like phantoms in his declining days. In his fourth and last
voyage, on approaching the coast of Cariay (Poyais, or Mosquito Coast), Veragua, and the Isthmus, he believed himself to be near the mouth of the Ganges.* These geographical illusions, this mysterious veil, which enveloped the first discoveries, contributed to magnify every object, and to fix the attention of Europe on regions, the very names of which are, to us, scarcely known. New Cadiz, the principal seat of the pearl-fishery, was on an island which has again become uninhabited. The extremity of the rocky coast of Paria is also a desert. Several towns were founded at the mouth of the Rio Atrato, by the names of Antigua del Darien, Uraba, or San Sebastian de Buenavista. In these spots, so celebrated at the beginning of the sixteenth century, the historians of the conquest tell us that the flower of the Castilian heroes were found assembled: thence Balboa set out to discover the South Sea; Pizarro marched from thence to conquer and ravage Peru; and Pedro de Cieça constantly followed the chain of the Andes, by Antioquia, Popayan, and Cuzco, as far as La Plata, after having goue 900 leagues by land. These towns of Darien are destroyed; some ruins scattered on the hills of Uraba, the fruit-trees of Europe mixed with native trees, are all that mark to the traveller the spots on which those towns once stood. In almost all Spanish America the first lands peopled by the Conquistadores, have retrograted into barbarism. $\dagger$

[^431]Other countries, discoresed later, attract the attention of the colonists: such is the natural progress of things in peopling a vast continent. It may be hoped that on several points the people will return to the places that were first chosen. It is difficult to conceive why the mouth of a great river, descending from a country rich in gold and platina, should have remained uninhabited. The Atrato, heretofore called Rio del Darien, de San Juan, or Dabayba, has had the same fate as the Orinoco. The Indians who wander around the delta of those rivers continue in a savage state.

We weighed anchor in the road of Zapote, on the 27th March, at sunrise. The sea was less stormy, and the weather rather warmer, although the fury of the wind was undiminished. We saw on the north a succession of small cones of extraordinary form, as far as the Morro de Tigua; they are known by the name of the Paps (tetas) of
of 2000 Spaniards; while the latter, the Ciudad de Uraba, remained uninhabited, because Erancisco Pizarro, since known as the conqueror of Pera, was forced to abandon it, having vainly demanded succour from St. Domingo. The historian Herrera, after having said that the foundation of Antigua had preceded by one year that of Uraba or San Sebastian, affirms the contrary in the following chapter, and in the Chronicle itself. It was, according to the Chronicle, in 1501, that Ojeda, accompanied by Vespucci, and penetrating for the first time the Gulf of Uraba or Darien, "resolved to construct, with wood and unbaked bricks, a fort at the entrance of Culata." It appears, however, that this enterprise was not executed; for, in 1508, in the convention made by Ojeda and Nicuessa, they each promised to build two fortresses on the limits of New Andalusia and of Castillo del Oro. Herrera, in the 7th and 8th books of the first Decade, fixes the foundation of San Sebastian de Uraba at the beginning of 1510 , and mentions it as the most ancient town of the continent of America, after that of Ceragua, founded by Columbus in 1503, on the Rio Belen. He relates how Francisco Pizarro abandoned that town, and how the foundation of the Ciudad del Antigua by Entiso, towards the end of the year 1510, was the consequence of that event. (Leo $\mathbf{X}$. made Antigua a bishopric, in 1514; and this was the first episcopal charch of the continent. In 1519, Pedrarius Davila persuaded the court of Madrid, by false reports, that the site of the new town of Panama was more healthful than that of Antigua, the inhabitants were compelled to abandon the latter town, and the bishopric was transferred to Panama. The Gulf of Uraba was deserted during thirteen years, till the founder of the town of Carthagena, Pedro de Heredia, after having dug up the graves, or huacas, of the Rio Sinu, to collect gold, sent his brother Alonzo, in 1532, to repeople Uraba, and reconstruct on that spot a town under the name of San Sebastian de Buenavista )

Santero, Tolu, Rincon, and Chichimar. The two latter are nearest the coast. The Tetas de Tolu rise in the middle of the savannahs. There, from the trunks of the Toluifera balsamum, is collected the precious balsam of Tolu, heretofore so celebrated in the pharmacopoias of Europe, and in which is a profitable article of trade at Corozal, Caimito, and the town of Tocasuan. In the savannahs (altas del Tolu), oxen and mules wander half wild. Several of those hills, between Cienega de Pesquero and the Punta del Comissario, are linked two-and-two together, like basadtic columns; it is, however, very probable that they are calcareous, like the Tetas de Managua, south of the Havannah. In the archipelago of San Bernardo, we passed between the island of Salamanquilla and Cape Boqueron. We had scarcely quitted the gulf of Morosquillo, when the sea became so rough, that the waves frequently washed over the deck of our little vessel. It was a fine moonlight night. Our captain sought in vain a sheltering-place on the coast, to the north of the village of Rincon. We cast anchor at four fathoms; but having discovered that we were lying over a reef of coral, we preferred the open sea.

The coast has a singular configuration beyond the Morro de Tigua, the terminatory point of the group of little mountains which rise like islands from the plain. We found at first a marshy soil, extending over a square of eight leagues, between the Bocas de Matuna and Matunilla. These marshes are connected by the Cienega de la Cruz, with the Dique of Mahates and the Rio Magdalena. The island of Baru, which, with the island of Tierra Bomba, forms the vast port of Carthagena, is, properly speaking, but a peninsula fourteen miles long, separated from the continent by the narrow channel of Pasacaballos. The archipelago of San Bernardo is situated opposite Cape Boqueron. Another archipelago, called Rosario, lies off the southern point of the peninsula of Baru. These rents in the coast are repeated at the $103^{\circ}$ and $11^{\circ}$ of latitude. The peninsulas near the Ensenada of Galera de Zamba, and near the port of Savanilla, have the same aspect as the peninsula Baru. Similar causes have produced similar effects; and the geologist must not neglect those analogies, in the configuration of a coast which, from Punta Caribana
in the mouth of the Atrato, beyond the cape of La Vela, along an extent of 120 leagues, has a general direction from S.W. to N.E.

The wind having dropped during the night we could only advance to the island of Arenas, where we anchored. I found it was $78^{\circ} 2^{\prime} 10^{\prime \prime}$ of longitude. The weather became stormy during the night. We again set sail on the morning of the 29th of March, hoping to be able to reach Boca Chica that day. The gale blew with extreme violence, and we were unable to proceed with our frail bark against the wind and the current, when, by a false manœuure in setting the sails, (we had but four sailors), we were during some minutes in imminent danger. The captain, who was not a very bold mariner, declined to proceed further up the coast, and we took refuge, sheltered from the wind, in a nook of the island of Baru, south of Punta Gigantes. It was Palm Sunday; and the Zambo, who had accompanied us to the Orinoco, and did not leave us till we returned to France, reminded us that on the same Sunday in the preceding year, we had nearly been lost, on the north of the mission of Uruana.

There was to be an eclipse of the moon during the night, and the next day an occultation of $a$ Virginis. The observation of the latter phenomenon might have been very important in determining the longitude of Cathagena. In vain I urged the captain to allow one of his sailors to accompany me by land to the foot of Boca Chica, a distance of five miles. He objected on account of the wild state of the country, in which there is neither habitation nor path. A little incident, which might have rendered Palm-Sunday more fatal, justified the prudence of the captain. We went by moonlight, to collect plants on the shore; as we approached the land, we saw a young negro issue from the thicket. He was quite naked, loaded with chains, and armed with a machete. He invited us to land on a part of the beach covered with large mangroves, as being a spot where the surf did not break, and offered to conduct us to the interior of the island of Baru, if we would promise to give him some clothes. His cunning and wild appearance, the often-repeated question whether we were Spaniards, and certain unintelligible words which he addressed to some
of his companions who were concealed amidst the trees, inspired us with some mistrust. These blacks were no doubt maroon negroes: slaves escaped from prison. This unfortunate class are much to be feared: they have the courage of despair, and a desire of vengeance excited by the severity of the whites. We were without arms ; the negroes appeared to be more numerous than we were, and, thinking that possibly they invited us to land with the desire of taking possession of our canoe, we thought it most prudent to return on board. The aspect of a naked man, wandering on an uninhabited beach, unable to free himself from the chains fastened round his n -ck and the upper part of his arm, was an object calculated to excite the most painful impressions. Our sailors wished to return to the shore for the purpose of seizing the fugitives, to sell them secretly at Carthagena. In countries where slavery exists, the mind is familiarized with suffering, and that instinct of pity which characterizes and enobles our nature, is blunted.

Whilst we lay at anchor near the island of Baru, in the meridian of Punta Gigantes, I observed the eclipse of the moon of the 29th of March, 1801. The total immersion took place at $11^{\mathrm{h}} 30^{\prime} 12 \cdot 6^{\circ}$ mean time. Some groups of vapours, scattered over the azure vault of the sky, rendered the observation of the immersion uncertain.

During the total eclipse, the lunar disc displayed, as almost always happens, a reddish tint, without disappearing; the edges, examined with a sextant, were strongly undulating, notwithstanding the considerable altitude of the orb. It appeared to me that the moon was more luminous than I had ever seen it in the temperate zone. The vividness of the light, it may be conceived, does not depend solely on the state of the atmosphere, which reflects, more or less feebly, the solar rays, by inflecting them in the cone of the shade. The light is also modified by the variable transparency of that part of the atmosphere across which we perceived the moon eclipsed. Within the tropics, great serenity of the sky, and a perfect dissolution of the vapours, diminish the extinction of the light sent back to us by the lunar disc. I was singularly struck, during the eclipse, by the want of uniformity in the distribution of the refracted light by the terrestial atmosphere. In the central region of
the disc there was a shadow, like a round cloud, the movement of which was from east to west. The part where the immersion was to take place was consequently, a few minutes prior to the immersion, much more brightly illumined than the western edges. Is this phenomenon to be attributed to an inequality of our atmosphere; to a partial accumulation of vapour, which, by absorbing a considerable part of the solar light, inflects less on one side the cone of the shadow of the earth? If a similar cause, in the perigee of central eclipses, sometimes renders the disc invisible, may it not happen also that only a small portion of the moon is seen; a disc, irregularly formed, and of which different parts were successively enlightened?

On the morning of the 30th of March we doubled Punta Gigantes, and made for the Boca Chica, the present entrance of the port of Carthagena. From thence the distance is seven or eight miles to the anchorage near the town; and although we took a practico to pilot us, we repeatedly touched on the sandbanks. On landing, I learned, with great satisfaction, that the expedition appointed to take the survey of the coast, under the direction of M. Fidalgo, had not yet put to sea. This circumstance not only enabled me to ascertain the astronomical position of several towns on the shore, which had served me as points of departure in fixing chronometrically the longitude of the Llanos and the Orinoco, but also served to guide me with respect to the future direction of my journey to Peru. The passage from Carthagena to Porto Bello, and that of the isthmus by the Rio Chagres and Cruces, are alike short and easy; but it was to be feared, that we might stay long at Panama before we found an opportunity of proceeding to Guayaquil, and in that case the voyage on the Pacific would be extremely lingering, as we should have to sail against contrary winds and currents. I relinquished with regret the hope of levelling by the barometer, the mountains of the isthmus, though it would then have been difficult to foresee that at the present time (1827), while measurements have been effected on so many other points of Mexico and Columbia, we should remain in ignorance of the height of the ridge which divides the waters in the isthmus. The persons we consulted all agreed that the journey by land
along the Cordilleras, by Santa Fé de Bogota, Popayan, Quite, and Caxamarca, would be preferable to the sea-voyage, and would furnish an immense field for exploration. The predilection of Europeans for the tierras frias, that is to say, the cold and temperate climate that prevails on the back of the Andes, gave further weight to these counsels. The distances were known, but we were deceived with respect to the time it would take to traverse them on mules' backs. We did not imagine that it would require more than eighteen months to ge from Carthagena to Lima. Notwithstanding this delay, or rather owing to the slowness with which we passed through Cundinamarca, the provinces of Popayan, and Quito, I did not regret having sacrificed the passage of the isthmus to the route of Bogota, for every step of the journey was full of interest both geographically and botanically. This change of direction gave me occasion to trace the map of the Rio Magdalena, to determine astronomically the position of eighty points situated in the inland country between Carthagena, Popayan, and the upper course of the river Amazon and Lima, to discover the error in the longitude of Quito, to collect several thousand new plants, and to observe on a vast scale the relations between the rocks of syenitic porphyry and trachyte, with the fire of volcanoes.

The result of those labours, of which it is not for me to appreciate the importance, have long since been published. My map of the Rio Magdalena, multiplied by the copies of the year 1802 in America and Spain, and comprehending the country between Almaguer and Santa Marta, from $1^{\circ} 54^{\prime}$ to $11^{\circ} 15^{\prime}$ lat., appeared in 1816 . Till that period no traveller had undertaken to describe New Grenada; and the public, except in Spain, knew the navigation of the Magdalena only by some lines traced by Bouguer. That learned traveller had descended the river from Honda; but, being in want of astronomical instruments, he had ascertained but four or five latitudes, by means of small dials hastily constructed. The narratives of travels in America are now singularly multiplied. Political events have led numbers of persons to those countries: and travellers have perhaps too hastily published their journals on returning to Europe. They have described the towas where they resided, and
landscape scenery remarkable for beauty; they have furnished information respecting the inhabitants, and the different modes of travelling in barks, on mules, or on men's backs. These works, several of which are agreeable and instructive, have familiarized the nations of the Old World with those of Spanish America, from Buenos Ayres and Chili as far as Zacatecas and New Mexico. But unfortunately, in many instances, the want of a thorough knowledge of the Spanish language, and the little care taken to acquire the names of places, rivers, and tribes, have occasioned extraordinary mistakes.

During the six days of our stay at Carthagena, our most interesting excursions were to the Boca Grande and the hill of Popa; the latter commands the town and a very extensive view. The port, or rather the bahia, is nearly nine miles and a half long, if we compute the length from the town (near the suburb of Jehemani or Xezemani) to the Cienega of Cacao. The Cienega is one of the nooks of the isle of Baru, south-west of the Estero de Pasacaballos, by which we reach the opening of the Dique de Mahates. Two extremities of the small island of Tierra Bomba form, on the north, with a neck of land of the continent, and on the south, with a cape of the island of Baru; the only entrances to the Bay of Carthagena; the former is called Boca Grande, the second Boca Chica. This extraordinary conformation of the land has given birth, for the space of a century, to theories entirely contradictory respecting the defence of a place, which, next to the Havannah and Porto Cabello, is the most important of the main land and the West Indies. Engineers differed respecting the choice of the opening which should be closed ; and it was not, as some writers have stated, after the landing of Admiral Vernon, in 1741, that the idea was first conceived* of filling up the Boca Grande. The English forced the small entrance, when they made themselves

[^432]masters of the bay; but being unable to take the town of Carthagena, which made a gallant resistance, they destroyed the Castillo Grande, (called also Santa Cruz) and the two forts of San Luis and San Jose, which defended the Boca Chica.

The apprehension excited by the proximity of the Boca Grande to the town determined the court of Madrid, after the English expedition, to shut up the entrance along a distance of 2640 varas. From two and a half to three fathoms of water were found ; and a wall, or rather a dyke, in stone, from fifteen to twenty feet high, was raised on piles. The slope on the side of the water is unequal, and seldom $45^{\circ}$. This immense work was completed under the Viceroy Espeleta, in 1795. But art could not vanquish nature; the sea is unceasingly though gradually silting up the Boca Chica, while it labours unceasingly to open and enlarge the Boca Grande. The currents which, during a great part of the year, especially when the bendavales blow with violence, ascend from S.W. to N.E., throw sand into the Boca Chica, and even into the bay itself. The passage, which is from seventeen to eighteen fathoms deep, becomes more and more narrow,* and if a regular cleansing be not established by dredging machines, vessels will not be able to enter without risk. It is this small entrance which should have been closed; its opening is only 250 toises, and the passage or navigable channel is 110 toises. If it should one day be determined to abandon the Boca Chica, and re-establish the Boca Grande in the state which nature seems to prescribe, new fortifications must be constructed on the S.S.W. of the town. This fortress has always required great pecuniary outlays to keep it up.

The insalubrity of Carthagena varies with the state of the great marshes that surround the town on the east and north. The Cienega de Tesca is more than fifteen miles long; it communicates with the ocean, where it approaches the village of Guayeper. When, in years of drought, the

[^433]heaped-up earth prevents the salt water from covering the whole plain, the emanations that rise during the heat of the day, when the thermometer stands between $28^{\circ}$ and $32^{\circ}$ are very pernicious to the health of the inhabitants. A small portion of hilly land separates the town of Carthagena and the islet of Manga from the Cienega de Tesca. Those hills, some of which are more than 500 feet high, command the town. The Castillo de San Lazaro is seen from afar rising like a great rocky pyramid; when examined nearer its fortifications are not very formidable. Layers of clay and sand, belonging to the tertiary formation of nagelfuhe, are covered with bricks, and furnish a kind of construction which has little stability. The Cerro de Santa Maria de la Popa, crowned by a convent and some batteries, rises above the fort of San Lazaro, and is worthy of more solid and extensive works. The image of the Virgin, preserved in the church of the convent, has been long revered by mariners. The hill itself forms a prolonged ridge from west to east. The calcareous rock, with cardites, meandrites, and petrified corals, somewhat resembles the tertiary limestone of the peninsala of Araya, near Cumana. It is split and decomposed in the steep parts of the rock, and the preservation of the convent on so unsolid a foundation is considered by the people as one of the miracles of the patron of the place. Near the Cerro de la Popa there appears, on several points, breccia with a limestone cement containing angular fragments of Lydian stone. Whether this formation of nagel fluhe is superposed on tertiary limestone of coral, and whether the fragments of the Lydian stone come from secondary limestone, analogous to that of Zacatecas and the Moro de Nueva Barcelona, are questions which I have not had leisure to investigate. The view from the Popa is extensive and varied, and the windings and rents of the coast give it a peculiar character. I was assured that sometimes from the windows of the convent, and even in the open sea, before the fort of Boca Chica, the snowy tops of the Sierra Neràda de Santa Marta are discernible. The distance of the Horqueta to the Popa is seventy-eight nautical miles. This group of colossal mountains is most frequently wrapped in thick clouds : and it is most veiled at the season when the gales blow with violence. Although only forty-
five miles distant from the coast, it is of little service as a signal to mariners who seek the port of Saint Marta. Fidalgo during the whole time of his operations, near the shore, could take only one observation of the Nevados.
A gloomy vegetation of cactus, Jatropha gossypifolia, croton and mimosa, covers the barren declivity of Cerro de la Popa. In herbalizing in those wild spots, our guides shewed us a thick bush of Acacia cornigera, which had become celebrated by a deplorable event. Of all the species of mimosa the acacia is that which is armed with the sharpest thorns ; they are sometimes two inches long; and being hollow, serve for the habitation of ants of an extraordinary size. A woman, annoyed by the jealousy and well founded reproaches of her husband, conceived a project of the most barbarous vengeance. With the assistance of her lover she bound her husband with cords, and threw him, at night, into a bush of Mimosa cornigera. The more violently he struggled, the more the sharp woody thorns of the tree tore his skin. His cries were heard by persons who were passing, and he was found after several hours of suffering, covered with blood, and dreadfully stung by the ants. This crime is perhaps without example in the history of human turpitude: it indicates a violence of passion less assignable to the climate than to the barbarism of manners prevailing among the lower class of the people.
My most important occupation at Carthagena was the comparison of my observations with the astronomical positions, fixed by the officers of the expedition of Fidalgo. In the year 1783 (under the ministry of M. Valdès), Don Josef Espinosa, Don Dionisio Galiano, and Don Josef de Lanz, proposed to the Spanish government a plan for taking a survey of the coast of America, in order to extend the atlas of Tofino to the western colonies. The plan was approved; but it was not till 1792, that an expedition was fitted out at Cadiz, and they were enabled to commence their scientific operations at the island of Trinidad.


## CHAPTER XXXI.

CUBA AND THE SLAVE TBADE.

I might enumerate among the causes of the lowering of the temperature at Cuba during the winter months, the great number of shoals with which the island is surrounded, and on which the heat is diminished several degrees of centesimal temperature. This diminished heat may be assigned to the molecules of water locally cooled, which go to the bottom; to the polar currents, which are borne toward the abyss of the tropical ocean, or to the mixture of the deep waters with those of the surface at the declivities of the banks. But the lowering of the temperature is partly compensated by the flood of hot water, the Gulf Stream, which runs along the north-west coast, and the swiftness of which is often diminished by the north and northeast winds. The chain of shoals which encircles the island, and which appears on our maps like a penumbra, is fortunately broken on several points, and those interruptions afford free access to the shore. In the south-east part, the proximity of the lofty primitive mountains renders the coast more precipitous. In that direction are situated the ports of Santiago de Cuba, Guantanamo, Baitiqueri, and (in turning the Punta Maysi) Baracoa. The latter is the place most early peopled by Europeans. The entrance to the Old Channel, from Punta de Mulas, W.N.W. of Baracoa, as far as the new settlement which has taken the name of Puerto de las Nuevitas del Principe, is alike free trom shoals and breakers. Navigators find excellent anchorage a little to the east of Punta de Mulas, in the three rocks of Tanamo, Cabonico, and Nipe; and on the west of

Punta de Mulas, in the ports of Sama, Naranjo, del Padre, and Nuevas Grandes. It is remarkable, that near the latter port, almost in the same meridian where, on the southern side of the island, are situated the shoals of Buena Esperanza and of Las doce Leguas, stretching as far as the island of Pinos, we find the commencement of the uninterrupted series of the cayos of the Old Channel, extending to the length of ninety-four leagues, from Nuevitas to Punta Icacos. The Old Channel is narrowest opposite to Cayo Cruz and Cayo Romano; its breadth is scarcely more than five or six leagues. On this point, too, the Great Bank of Bahama takes its greatest development. The Cayos nearest the island of Cuba, and those parts of the bank not covered with water (Long Island, Eleuthera) are, like Cuba, of a long and narrow shape. Were they only twenty or thirty feet higher, an island much larger than St. Domingo would appear at the surface of the ocean. The chain of breakers and cayos that bound the navigable part of the Old Channel towards the south, leave between the channel and the coast of Cuba small basins without breakers, which communicate with several ports having good anchorage, such as Guanaja, Moron, and Remedios.
Having passed through the Old Channel, or rather the Channel of San Nicolas, between Cruz del Padre and the bauk of the Cayos de Sel, the lowest of which furnish springs of fresh water, we again find the coast, from Punta de Icacos to Cabañas, free from danger. It affords, in the interval, the anchorage of Matanzas, Puerto Escondido, the Havannah, and Muriel. Further on, westward of Bahia Honda, the possession of which might well tempt a maritime enemy of Spain, the chain of shoals recommences* and extends without interruption as far as Cape San Antonio. From that cape to Punta de Piedras and Bahia de Cortez, the coast is almost precipitous, and does not afford soundings at any distance; but between! Punta de Piedras and Cabo Cruz, almost the whole southern part of Cuba is surrounded with shoals of which the isle of Pinos is but a portion not covered with water. These shoals are distinguished on the west by the name of Gardens (Jardines y Jardinillos); and
. They are here called Bajos de Santa Isabel y de los Colorados.
on the east, by the names Cayo Breton, Cayos de las doce Leguas, and Bancos de Buena Esperanza. On all this southern line the coast is exempt from danger with the exception of that part which lies between the strait of Cochinos and the mouth of the Rio Guaurabo. These seas are very difficult to navigate. I had the opportunity of determining the position of several points in latitude and longitude during the passage from Batabano to Trinidad of Cuba and to Carthagena. It would seem that the resistance of the currents of the highlands of the island of Pines, and the remarkable out-stretching of Cabo Cruz, have at once favoured the accumulation of sand, and the labours of the coralline polypes which inhabit calm and shallow water. Along this extent of the southern coast a length of 145 leagues, only one-seventh affords entirely free access; viz. that part between Cayo de Piedras and Cayo Blanco, a little to the east of Puerto Casilda. There are found anchorages often frequented by small barks; for example, the Surgidero del Batabano, Bahia de Xagua, and Puerto Casilda, or Trinidad de Cuba. Beyond this latter port, towards the mouth of the Rio Cauto and Cabo Cruz (behind the Cayos de doce Leguas), the coast, covered with lagoons, is not very accessible, and is almost entirely desert.

At the island of Cuba, as heretofore in all the Spanish possessions in America, we must distinguish between the ecclesiastic, politico-military, and financial divisions. We will not add those of the judicial hierarchy, which have created so much confusion amongst modern geographers, the island having but one Audiencia, residing since the year 1797 at Puerto Principe, whose jurisdiction extends from Baracoa to Cape San Antonio. The division into two bishoprics dates from 1788, when Pope Pius VI. nominated the first bishop of the Havannah. The island of Cuba was formerly, with Louisiana and Florida, under the jurisdiction of the archbishop of San Domingo, and from the period of its discovery, it had only one bishopric, founded in 1518, in the most western part, at Baracoa, by Pope Leo X. The translation of this bishopric to Santiago de Cuba, took place four years later; but the first bishop, Fray Juan de Ubite, arrived only in 1528. In the beginning of the nine-
teenth century (1804), Santiago de Cuba was made an archbishopric. The ecclesiastical limit between the diocese of the Havannah and Cuba passes in the meridian of Cayo Romano, nearly in the $80 \frac{3}{4}^{5}$ of longitude west of Paris, between the Villa de Santo Espiritu and the city of Puerto Principe. The island, with relation to its political and military government, is divided into two goviernos, depending on the same capitan-general. The govierno of the Havannah comprehends, besides the capital, the district of the Quatro Villas (Trinidad, Santo Espiritu, Villa Clara, and San Juan de los Remedios), and the district of Puerto Principe. The Capitan-general y Gobernador of the Havannah has the privilege of appointing a lieutenant in Puerto Principe (Teniente Gobernador), as also at Trinidad and Nueva Filipina. The territorial jurisdiction of the capitan-general extends, as the jurisdiction of a corregidor, to eight pueblos de Ayuntamiento (the ciudades of Matanzas, Jaruco, San Felipe y Santiago, Santa Maria del Rosario; the villas of Guanabacoa, Santiago de las Vegas, Guines, and San Antonio de los Baños). The govierno of Cuba comprehends Santiago de Cuba, Baracoa, Holguin, and Bayamo. The present limits of the goviernos are not the same as those of the bishoprics. The district of Puerto Principe, with its seven parishes, for instance, belonged till 1814, to the govierno of the Havannah and the archbishopric of Cuba. In the enumerations of 1817 and 1820, we find Puerto Principe joined with Baracoa and Bayamo, in the jurisdiction of Cuba. It remains for me to speak of a third division altogether financial. By the cedula of the 23rd March, 1812, the island was divided into three Intendencias or Provincias ; those of the Havannah, Puerto Principe, and Santiago de Cuba, of which the respective length from east to west is about ninety, seventy, and sixty-five sea-leagues. The intendant of the Havannah retains the prerogatives of Superintendente general subdelegado de Real Hacienda de la $I_{s l a}$ de Cuba. According to this division, the Provincia de Cuba comprehends Santiago de Cuba, Baracoa, Holguin, Bayamo, Gibara, Manzanillo, Jiguani, Cobre, and Tiguaros; the Provincia de Puerto Principe, the town of that name, Nuevitas, Jagua, Santo Espiritu, San Juan de los Remedios, Villa de Santa Clara, and Trinidad. The most westerly
intendancia, or Provincia de la Havannah, occupies all that part situated west of the Quatro Villas, of which the intendant of the capital has lost the financial administration. When the cultivation of the land shall be more uniformly advanced, the division of the island into five departments, viz.: the vuelta de abaxo (from Cape San Antonio to the fine village of Guanajay and Mariel), the Havannah (from Mariel to Alvarez), the Quintas Villas (from Alvarez to Moron), Puerto Principe (from Moron to Rio Cauto), and Cuba (from Rio Cauto to Punta Maysi), will perhaps appear the most fit, and most consistent with the historical remembrances of the early times of the Conquest.

My map of the island of Cuba, however imperfect it may be for the interior, is yet the only one on which are marked the thirteen ciudades; and also seven villas, which are included in the divisions I have just enumerated. The boundary between the two bishoprics (linea divisoria de los dos obispados de la Havana $y$ de Santiago de Cuba) extends from the mouth of the small river of Santa Maria (long. $80^{\circ} 49^{\prime}$ ), on the southern coast, by the parish of San Eugenio de la Palma, and by the haciendas of Santa Anna, Dos Hermanos, Copey, and Cienega, to La Punta de Judas (long. $80^{\circ} 46^{\prime}$ ), on the northern coast, opposite Cayo Romano. During the régime of the Spanish Cortes, it was agreed that this ecclesiastical limit should be also that of the two Deputaciones provinciales of the Havannah and of Santiago. (Guia Constitucional de la isla de Cuba, 1822, p. 79). The diocese of the Havannah comprehends forty, and that of Cuba twenty-two, parishes. Having been established at a time when the greater part of the island was occupied by farms of cattle (haciendas de ganado), these parishes are of too great extent, and little adapted to the requirements of present civilization. The bishopric of Santiago de Cuba contains the five cities of Baracoa, Cuba, Holguin, Guiza, Puerto Principe, and the Villa of Bayamo. In the bishopric of San Cristoval de la Havannah are included the eight cities of the Havannah, viz.: Santa Maria del Rosario, San Antonio Abad or de los Baños, San Felipe y Santiago del Bejucal, Matanzas, Jaruco, La Paz, and Trinidad, and the six villas of Guanabacoa, viz.: Santiago de las Vegas or Compostela, Santa Clara, San Juan de los Reme-
dios, Santo Espiritu, and S. Julian de los Guines. The territorial division most in favour among the inhabitants of the Havannah, is that of vuelta de arriba and de abaxo, east and west of the meridian of the Havannah. The first governor of the island who took the title of Captain-general (1601), was Don Pedro Valdes. Before him there were sixteen other governors, of whom the series begins with the famous Poblador and Conquistador, Diego Velasquez, native of Cuellar, who was appointed by Columbus in 1511.

In the island of Cuba free men compose 64 of the whole population; and in the English islands, scarcely -19. In the whole archipelago of the West Indies, the coppercoloured men (blacks and mulattos, free and slaves) form a mass of $2,360,000$, or 83 of the total population. If the legislation of the West Indies and the state of the men of colour do not shortly undergo a salutary change; if the legislation continue to employ itself in discussion instead of action, the political preponderance will pass into the hands of those who have strength to labour, will to be free, and courage to endure long privations. This catastrophe will ensue as a necessary consequence of circumstances, without the intervention of the free blacks of Hayti, and without their abandoning the system of insulation which they have hitherto followed. Who can venture to predict the influence which may be exercised on the politics of the New World by an African Confederation of the free states of the West Indies, situated between Columbia, North America, and Guatimala? The fear of this event may act more powerfully on the minds of many, than the principles of humanity and justice; but in every island the whites believe that their power is not to be shaken. All simultaneous action on the part of the blacks appears to them impossible ; and every change, every concession granted to the slave population, is regarded as a sign of weakness. The horrible catastrophe of San Domingo is declared to have been only the effect of the incapacity of its government. Such are the illusions which prevail amidst the great mass of the planters of the West Indies, and which are alike opposed to an amelioration of the condition of the blacks in Georgia and in the Carolinas. The island of Cuba, more than any other of the West India Islands, might escape the
common wreck. That island contains 455,000 free men and 160,000 slaves: and there, by prudent and humane measures, the gradual abolition of slavery might be brought about. Let us not forget, that since San Domingo has become free, there are in the whole archipelago of the West Indies, more free negroes and mulattos than slaves. The whites, and above all, the free men, whose cause it would be easy to link with that of the whites, take a very rapid numerical increase at Cuba. The slaves would have diminished, since 1820, with great rapidity, but for the fraudulent continuation of the slave-trade. If, by the progress of human civilization, and the firm resolution of the new states of free America, this infamous traffic should cease altogether, the diminution of the slave population would become more considerable for some time, on account of the disproportion existing between the two sexes, and the continuance of emancipation. It would cease only when the relation between the deaths and births of slaves should be such that even the effects of enfranchisement would be counterbalanced. The whites and free men now form two-thirds of the whole population of the island, and this increase marks in some degree the diminution of the slaves. Among the latter, the women are to the men (exclusive of the mulatto slaves), scarcely in the proportion of $1: 4$, in the sugar-cane plantations; in the whole island, as $1: 177$; and in the towns and farms where the negro slaves serve as domestics, or work by the day on their own account as well as that of their masters, the proportion is as $1: 1 \cdot 4$; even (for instance at the Havannah),* as $1: 1.2$. The developments that follow, will show that these proportions are founded on numerical statements, which may be regarded as the limit-numbers of the maximum.

The prognostics which are hazarded respecting the diminution of the total population of the island, at the period

[^434]when the slave-trade shall be really abolished, and not merely according to the laws, as since 1820 , respecting the impossibility of continuing the cultivation of sugar on a large scale, and respecting the approaching time when the agricultural industry of Cuba shall be restrained to plantations of coffee and tobacco, and the breeding of cattle, are founded on arguments which do not appear to me to be perfectly just. Instead of indulging in gloomy presages, the planters would do well to wait till the government shall have procured positive statistical statements. The spirit in which even very old cnumerations were made, for instance that of 1775, by the distinction of age, sex, race, and state of civil liberty, deserves high commendation. Nothing but the means of executicn were wanting. It was felt that the inhabitants were powerfully interested in knowing partially the occupations of the blacks, and their numerical distribution in the sugar-settlements, farms, and towns. To remedy evil, to avoid public danger, to console the misfortunes of a suffering race, who are feared more than is acknowledged, the wound must be probed; for in the social body, when governed by intelligence, there is found, as in organic bodies, a repairing force, which may be opposed to the most inveterate evils.

In the year 1811 the municipality and the Tribunal of Commerce of the Havannah computed the total population of the island of Cuba to be 600,000 , including 326,000 people of colour, free or slaves, mulattos or blacks. At that time, nearly three-fifths of the people of colour resided in the jurisdiction of the Havannah, from Cape Saint Antonio to Alrarez. In this part it appears that the towns contained as many mulattos and free negroes as slaves, but that the coloured population of the towns was to that of the fields as tro to three. In the eastern part of the island, on the contrary, from Alvarez to Santiago de Cuba and Cape Maysi, the men of colour inhabiting the towns, nearly equalled in number those scattered in the farms. From 1811 till the end of 1825, the island of Cuba has received along the whole extent of its coast, by lawful and unlawful means, 185,000 African blacks, of whom the custom-house of the Havannah only, registered, from 1811 to 1820, about 116,000. This newly introduced mass has no doubt been spread more
in the country than in the towns; it must have changed the relations which persons well informed of the localities had established in 1811, between the eastern and western parts of the island, between the towns and the fields. The negro slaves have much augmented in the eastern plantations; but the fact that, notwithstanding the importation of 185,000 bozal negroes, the mass of men of colour, free and slaves, has not augmented, from 1811 to 1825 , more than 64,000 , or one-fifth, shews that the changes in the relation of partial distribution are restrained within narrower limits than one would at first be inclined to admit.
The proportions of the castes with respect to each other will remain a political problem of high importance till such time as a wise legisiation shall have succeeded in calming inveterate animosities, and in granting equality of rights to the oppressed classes. In 1811, the number of whites in the island of Cuba exceeded that of the slaves by 62,000 , whilst it nearly equalled the number of the people of colour, both free and slaves. The whites, who in the French and English islands formed at the same period nine-hundredths of the total population, amounted in the island of Cuba to fortyfive hundredths. The free men of colour amounted to nineteen hundredths, that is, double the numbè of those in Jamaica and Martinique. The numbers given in the enumeration of 1817, modified by the Deputacion Provincial, being only 115,700 freedmen and 225,300 slaves, the comparison proves, first, that the freedmen have been estimated with little precision either in 1811 or in 1817; and, secondly, that the mortality of the negroes is so great, that notwithstanding the introduction of more than 67,700 African negroes registered at the custom-house, there were only 13,300 more slaves in 1817 than in 1811.

In 1817 a new enumeration was substituted for the approximative estimates attempted in 1811. From the census of 1817 it appears that the total population of the island of Cuba amounted to 572,363 . The number of whites was 257,380 ; of free men of colour, 115,691, and of slaves 199,292.

In no part of the world where slavery prevails is emancipation so frequent as in the island of Cuba. The Spanish legislature favours liberty, instead of opposing it, like the

English and French legislatures. The right of every slave to choose his own master, or set himself tree, if he can pay the purchase-money, the religious feeling which disposes many masters in easy circumstances to liberate some of their slaves, the habit of keeping a multitude of blacks for domestic service, the attachments which arise from this intercourse with the whites, the facility with which slaves who are mechanics accumulate money, and pay their masters a certain sum daily, in order to work on their own account;--such are the principal causes which in the towns convert so many slaves into free men of colour. I might add the chances of the lottery, and games of hazard, but that too much confidence in those means often produces the most fatal effects.

The primitivo population of the West India Islands having entirely disappeared (the Zambo Caribs, a mixture of natives and negroes, having been transported in 1796, from St. Vincent to the island of Ratan), the present population of the islands $(2,850,000)$ must be considered as composed of European and African blood. The negroes of pure race form nearly two-thirds ; the whites one-fifth ; and the mixed race one-seventh. In the Spanish colonies of the continent, we find the descendants of the Indians who disappear among the mestizos and zambos, a mixture of Indians with whites and negroes. The archipelago of the West Indies suggests no such consolatory idea. The state of society was there such, at the beginning of the sixteenth century, that, with some rare exceptions, the new planters paid as little attention to the natives as the English now do in Canada. The Indians of Cuba have disappeared like the Guanches of the Canaries, although at Guanabacoa and Teneriffe false pretensions were renewed forty years ago, by several families, who obtained small pensions from the government on pretext of having in their veins some drops of Indian or Guanche blood. It is impossible now to form an accurate judgment of the population of Cuba or Hayti in the time of Columbus. How can we admit, with some, that the island of Cuba, at its conquest in 1511, had a million of inhabitants, and that there remained of that million, in 1517, only 14,000 ! The statistic statements in the writings of the bishop of Chiapa are full of contradic-
tions. It is related that the Dominican monk, Fray Luys Bertram, who was persecuted* by the encomonderos, as the Methodists now are by some English planters, predicted that "the 200,000 Indians which Cuba contained, would perish the victims of the cruelty of Europeans." If this be true, we may at least conclude, that the native race was far from being extinct between the years 1555 and 1569; but according to Gomara (such is the confusion among the historians of those times) there were no longer any Indians on the island of Cuba in 1553. To form an idea of the vagueness of the estimates made by the first Spanish travellers, at a period when the population of no province of the peninsula was ascertained, we have but to recollect that the number of inhabitants which Captain Cook and other navigators assigned to Otaheite and the Sandwich Islands, at a time when statistics furnished the most exact comparisons, varied from one to five. We may conceive that the island of Cuba, surrounded with coasts adapted for fishing, might, from the great fertility of its soil, afford sustenance for several millions of those Indians who have no desire for animal food, and who cultivate maize, manioc, and other nourishing roots; but had there been that amount of population, would it not have been manifest by a more advanced degree of civilization than the narrative of Columbus describes? Would the people of Cuba have remained more backward in civilization than the inhabitants of the Lucayes Islands? Whatever activity may be attributed to causes of destruction, such as the tyranny of the conguistadores, the faults of governors, the too severe labours of the goldwashings,' the small-pox, and the frequency of suicides, $\dagger$

[^435]it would be difficult to conceive how in thirty or forty years three or four hundred thousand Indians could entirely disappear. The war with the Cacique Hatuey was short, and was confined to the most eastern part of the island. Few complaints arose against the administration of the two first Spanish governors, Diego Velasquez and Pedro de Barba. The oppression of the natives dates from the arrival of the cruel Hernando de Soto, about the year 1539. Supposing, with Gomara, that fifteen years later, under the government of Diego de Majariegos (1554-1564), there were no longer any Indians in Cuba, we must necessarily admit that considerable remains of that people saved themselves by means of canoes in Florida, believing, according to ancient traditions, that they were returning to the country of their ancestors. The mortality of the negro slaves, observed in our days in the West Indies, can alone throw some light on these numerous contradictions. To Columbus and Velasquez, the island of Cuba must have appeared well peopled,*

Juan Nuix, y traducido al castellano por Don Pedro Varela y Ulloa, del Consejo de S. M., 1782." [Impartial reflections on the humanity of the Spaniards, intended to contravert pretended philosophers and politicians, and to illustrate the histories of Raynal and Robertson; written in Italian by the Abate Don Juan Nuix, and translated into Castilian by Don Pedro Varela y Ulloa, member of His Majesty's Council.] The author, who calls the expulsion of the Moors under Philip III, a meritorious and religious act, terminates his work by congratulating the Indians of America " on having fallen into the hands of the Spaniards, whose conduct has been at all times the most humane, and their government the wisest." Several pages of this book recall " the salutary rigour of the Dragonades;" and that odious passage, in which a man distinguished for his talents and his private virtues, the Count de Maistre (Soirées de St. Petersbourg, tom. ii, p. 121), justifies the Inquisition of Portugal, "which he observes has only caused some drops of guilty blood to flow." To what sophisms

* must they have recourse, who would defend religion, national honour, or
, the stability of governments, by exculpating all that is offensive to humanity in the actions of the clergy, the people, or kings ! It is vain to seek to destroy the power most firmly established on earth, viz. :-the testimony of history.
* Columbus relates that the island of Hayti was sometimes attacked by a race of black men, (gente negra), who lived more to the south or southwest. He hoped to visit them in his third voyage, because those black men possessed a metal, of which the admiral had procured some pieces in his second voyage. These pieces were sent to Spain, and found to be composed of $\cdot 63$ of gold, $\cdot 14$ of silver, and $\cdot 19$ of copper. In fact,
if, for instance, it contained as many inhabitants as were found there by the English in 1762. The first travellers were easily deceived by the crowds which the appearance of European vessels brought together on some points of the coast. Now, the island of Cuba, with the same ciudades and villas which it possesses at present, had not in 1762 more than 200,000 inhabitants; and yet, among a people treated like slaves, exposed to the violence and brutality of their masters, to excess of labour, want of nourishment, and the ravages of the small-pox,-forty-two years would not suffice to obliterate all but the remembrance of their misfortunes on the earth. In several of the Lesser Antilles, the population diminishes under English domination five and six per cent. annually; at Cuba, more than eight per cent. ; but the annihilation of 200,000 in forty-two years, supposes an annual loss of twentr-six per cent., a loss scarcely credible, although we may suppose that the mortality of the natives of Cuba was much greater than that of negroes bought at a very high price.

In studying the history of the island, we observe that the
Balboa discovered this black tribe in the Isthmus of Darien. "That conquistador," says Gomara, "entered the province of Quareca: he found no gold, but some blacks, who were slaves of the lord of the place. He asked this lord whence he had received them; who replied, that men of that colour lived near the place, with whom they were constantly at war . . . . . These negroes," adds Gomara, " exactly resemble those of Guinea ; and no others have since been seen in America (en las Indias yo pienso que no se han visto negros despues.") The passage is very remarkable. Hypotheses were formed in the sixteenth century, as now ; and Petrus Martyr imagined that these men seen by Balboa, (the
. ${ }^{\text {L }}$ Quarecas), were Ethiopian blacks who, as pirates, infested the seas, and had been shipwrecked on the coast of America. But the negroes of Soudan are not pirates ; and it is easier to conceive that Esquimaux, in their hoats of skins, may have gone to Europe, than the Africans to Darien. Those learned speculators who believe in a mixture of the Polynesians with the Americans, rather consider the Quarecas as of the race of Papuans, similar to the negritos of the Philippines. Tropical migrations from west to east, from the most western part of Polynesia to the Isthmus of Darien, present great difficulties, although the winds blow during whole weeks from the west. Above all, it is essential to know whether the Quarecas were really like the negroes of Soudan, as Gomara asserts, or whether they were only a race of very dark Indians (with smooth and glossy hair), who from time to time, before 1492, infested the coasts of the island of Hayti, which has become in our days the domain of Ethiopians.
movement of colonization has been from east to west; and that here, as everywhere in the Spanish colonies, the places first peopled are now the most desert. The first establishment of the whites was in 1511, when, according to the orders of Don Diego Columbus, together with the conquistador and poblador Velasquez, he landed at Puerto de Palmas, near Cape Maysi, then called Alfa y Omega, and subdued the cacique Hatuey, who, an emigrant and fugitive from Hayti, had withdrawn to the eastern part of the island of Cuba, and had become the chief of a confederation of petty native princes. The building of the town of Baracoa was begun in 1512 ; and later, Puerto Principe, Trinidad, the Villa de Santo Espiritu, Santiago de Cuba (1514), San Salvador de Bayamo, and San Cristoval de la Havaña. This last town was originally founded in 1515, on the southern coast of the island, in the Partido of Guines, and transferred, four years later, to Puerto de Carenas, the position of which at the entrance of the two channels of Bahama (el Viejo y el Nuevo) appears to be much more favourable to commerce than the coast on the south-west of Batabano.* The progress of civilization since the sixteenth century, has had a powerful influence on the relations of the castes with each other; these relations vary in the districts which contain only farms for cattle, and in those where the soil has been long cleared; in the sea-ports and inland towns, in the spots where colonial produce is cultivated, and in such as produce maize, vegetables, and forage.

Until the latter part of the eighteenth century, the number of female slaves in the sugar plantations of Cuba was extremely limited; and what may appear surprising is, that a prejudice, founded on religious scruples, opposed the introduction of women, whose price at the Havannah was generally one-third less than that of men. The slaves were forced to celibacy on the pretext of avoiding moral disorder. The Jesuits and the Bethlemite monks alone renounced that fatal prejudice, and encouraged negresses in their planta-

* A tree is still shewn at the Havannah, (at Puerto de Carenas), under the sbade of which the Spaniards celebrated their first mass. The island, now called officially "The ever-faithful island of Cuba," was after its dis covery named successively Juana Fernandina, Isla de Santiago, and Isla del Ave Maria. Its arms date from the year 1516.

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tions. If the census, no doubt imperfect, of 1775, yielded 15,562 female, and 29,366 male slaves, we must not forget that that enumeration comprehended the totality of the island, and that the sugar plantations occupy even now but a quarter of the slave population. After the year 1795, the Consulado of the Havannah began to be seriously occupied with the project of rendering the increase of the slave population more independent of the variations of the slave-trade. Don Francisco Arango, whose views were ever characterized by wisdom, proposed a tax on the plantations in which the number of slaves was not comprised of one-third females. He also proposed a tax of six piastres on every negro brought into the island, and from which the women (negras bozales) should be exempt. These measures were not adopted, because the colonial assembly refused to employ coercive means; but a desire to promote marriages, and to improve the condition of the children of slaves, has existed since that period, when a cedula real (of the 22nd April, 1804) recommended those objects "to the conscience and humanity of the planters."

The first introduction of negroes into the eastern part of the island of Cuba, took place in 1521, and their number did not exceed 300. The Spaniards were then much less eager for slaves than the Portuguese; for, in 1539, there was a sale of 12,000 negroes at Lisbon, as in our days (to the eternal shame of Christian Europe) the trade in Greek slaves is carried on at Constantinople and Smyrna. In the sixteenth century the slave-trade was not free in Spain; the privilege of trading, which was granted by the court, was purchased in 1586, for all Spanish America, by Gaspar de Peralta; in 1595, by Gomez Reynel ; and in 1615, by Antonio Rodriguez de Elvas. The total importation then amounted to only 3500 negroes annually; and the inhabitants of Cuba, who were wholly engaged in rearing cattle, scarcely received any. During the war of succession, French ships were accustomed to stop at the Havannah and to exchange slaves for tobacco. The Asiento treaty with.the English in some degree augmented the introduction of negroes; yet in 1763, although the taking of the Havannah and the sojourn of strangers gave rise to new wants, the number of slaves in the jurisdiction of the Havannah did not amount
to 25,000 ; and in the whole island, not to 32,000 . The total number of African negroes, imported from 1521 to 1763, was probably 60,000 ; their descendants survive among the free mulattos, who inhabit for the most part the eastern side of the island. From the year 1763 to 1790 , when the negrotrade was declared free, the Hava.onah received 24,875 (by the Compañia de Tobacos 4957, from 1763 to 1766; by the contract of the Marquess de Casa Enrile, 14,132, from 1773 to 1779 ; by the contract of Baker and Dawson, 5786, from 1786 to 1789). If we estimate the introduction of slaves in the eastern part of the island during those twenty-seven years ( 1763 to 1790) at 6000, we find from the discovery of the island of Cuba, or rather from 1521 to 1790, a total of 90,875 . We shall soon see that by the ever-increasing activity of the slave-trade, the fifteen years that followed 1790, furnished more slaves than the two centuries and a half which preceded the period of the free trade. That activity was redoubled when it was stipulated between England and Spain, that the slave-trade should be prohibited north of the equator, from November 22nd, 1817, and entirely abolished on the 30th May, 1820. The King of Spain accepted from England (which posterity will one day scarcely believe), a sum of 400,000 pounds sterling, as a compensation for the loss which might result from the cessation of that barbarous commerce.

Jamaica received from Africa, in the space of three hundred years, 850,000 blacks; or, to fix on a more certain estimate, in one hundred and eight years (from 1700 to 1808) nearly 677,000 ; and yet that island does not now possess 380,000 blacks, free mulattos and slaves. The island of Cuba furnishes a more consoling result; it has 130,000 free men of colour, whilst Jamaica, on a total population half as great, contains only 35,000 .

On comparing the island of Cuba with Jamaica, the result of the comparison seems to be in favour of the Spanish legislation, and the morals of the inhabitants of Cuba. These comparisons demonstrate a state of things in the latter island more favorable to the physical preservation, and to the liberation of the blacks; but what a melancholy spectacle is that of Christian and civilized nations, discussing which of them has caused the fewest Africans to perish during the
interval of three centuries, by reducing them to slavery! Much cannot be said in commendation of the treatment of the blacks in the southern parts of the United States; but there are degrees in the sufferings of the human species. The slave who has a hut and a family, is less miserable than he who is purchased, as if he formed part of a flock. The greater the number of slaves established with their families in dwellings which they believe to be their own property, the more rapidly will their numbers increase.

The annual increase of the last ten years in the United States (without counting the manumission of 100,000 ), was twenty-six on a thousand, which produces a doubling in twenty-seven years. Now, if the slaves at Jamaica and Cuba had multiplied in the same proportion, those two islands (the former since 1795, and the latter since 1800) would possess almost their present population, without 400,000 blacks having been dragged from the coast of Africa, to Port-Royal and the Havannah.

The mortality of the negroes is very different in the island of Cuba, as in all the West Indies, according to the nature of their treatment, the humanity of masters and overseers, and the number of negresses who can attend to the sick. There are plantations in which fifteen to eighteen per cent. perish annually. I have heard it coolly discussed, whether it were better for the proprietor not to subject the slaves to excessive labour, and consequently to replace them less frequently, or to draw all the advantage possible from them in a few years, and replace them oftner by the acquisition of bozal negroes. Such are the reasonings of cupidity, when man employs man as a beast of burden! It would be unjust to entertain a doubt, that within fifteen years negro mortality has greatly diminished in the island of Cuba. Several proprietors have made laudable efforts to improve the plantation system.

It has been remarked, how much the population of the island of Cuba is susceptible of being augmented in the lapse of ages. As the native of a northern country, little favoured by nature, I may observe that the Mark of Brandebourg, for the most part sandy, contains, under an administration favourable to the progress of agricultural industry, on a surface only one-third of that of Cuba, a population
nearly double. The extreme inequality in the distribution of the population, the want of inhabitants on a great part of the coast, and its immense development, render the military defence of the whole island impossible: neither the landing of an enemy, nor illicit trade, can be prevented. The Havannah is well defended, and its works rival those of the most important fortified towns of Europe ; the Torreones, and the fortifications of Cogimar, Jaruco, Matanzas, Mariel, Bahia Honda, Batabano, Xagua, and Trinidad, might resist for a cousiderable time, the assaults of an enemy; but on the other hand two-thirds of the island are almost without defence, and could scarcely be protected bythe best gun-boats.

Intellectual cultivation is almost entirely limited to the whites, and is as unequally distributed as the population. The best society of the Havannah may be compared for easy and polished manners, with the society of Cadiz, and with that of the richest commercial towns of Europe; but on quitting the capital, or the neighbuuring plantations, which are inhabited by rich proprietors, a striking contrast to this state of partial and local civilization is manifest, in the simplicity e: manners prevailing in the insulated farms and small towns. The Havaneros or natives of Havannah were the first among the rich inhabitants of the Spanish colonies, who visited Spain, France, and Italy; and at the Havannah the people were always well informed of the politics of Europe. This knowledge of events, this prescience of future chances, have powerfully aided the inhabitants of Cuba to free themselves from some of the burthens which check the development of colonial prosperity. In the interval between the peace of Versailles and the beginning of the revolution of San Domingo, the Havannah appeared to be ten times nearer to Spain than to Mexico, Caracas, and New Grenada. Fifteen years later, at the period of my visit to the colonies, this apparent inequality of distance had considerably diminished; now, when the independence of the continental colonies, the importation of foreign manufactures, and the financial wants of the new states, have multiplied the intercourse between Europe and America; when the passage is shortened by improvements in navigation; when the Columbians, the Mexicans, and the inhabitants of Guatimala, rival each other in visiting Europe ; the ancient Spanish colonies-those
at least that are bathed by the Atlantic-seem alike to have drawn nearer to the continent. Such are the changes which a few years have produced, and which are proceeding with increasing rapidity. They are the effects of knowledge, and of long-restrained activity; and they render less striking the contrast in manners and civilization, which I observed at the beginning of the century, at Caracas, Bogota, Quito, Lima, Mexico, and the Havannah. The influences of the Basque, Catalanian, Galician, and Andalusian origin, become every day more imperceptible.

The island of Cuba does not possess those great and mag. nificent establishments, the foundation of which is of very remote date in Mexico; but the Havannah can boast of institutions which the patriotism of the inhabitants, animated by a happy rivalry between the different centres of American civilization, will know how to extend and improve, whenever political circumstances and confidence in the preservation of internal tranquillity may permit. The Patriotic Society of the Havannah (established in 1793); those of Santo Espiritu, Puerto Principe, and Trinidad, which depend on it; the university, with its chairs of theology, jurisprudence, medicine and mathematics, established since 1728, in the convent of the Padres Predicadores ;* the chair of political economy, founded in 1818; that of agricultural botany; the museum and the school of descriptive anatomy, due to the enlightened zeal of Don Alexander Ramirez; the public library, the free school of drawing and painting; the national school; the Lancastrian schools, and the botanic garden, are institutions partly new, and partly old. Some stand in need of progressive amelioration, others require a total reform, to place them in harmony with the spirit of the age, and the wants of society.

Aariculture.-When the Spaniards began their settlements in the islands and on the continent of America, those

[^436]productions of the soil chiefly cultivated were; as in Europe, the plants that serve to nourish man. This primitive stage of the agricultural life of nations, has been preserved till the present time in Mexico, in Peru, in the cold and temperate regions of Cundinamarca, in short, wherever the domination of the whites comprehends a vast extent of territory. The alimentary plants, bananas, manioc, maize, the cereals of Furope, potatoes, and quiñoa, have continued to be, at different heights above the level of the sea, the basis of continental agriculture within the tropies. Indigo, cotton, coffee, and sugar-cane, appear in those regions only in intercalated groups. Cuba, and the other islands of the archipelago of the Antilles, presented during the space of two centuries and a half, a uniform aspect: the same plants were cultivated which had nourished the half-wild natives, and the vast savannahs of the great islands were peopled with numerous herds of cattle. Piedro de Atienza planted the first sugar-canes in Saint Domingo, about the year 1520; and cylindrical presses, moved by water-wheels, were constructed.* But the island of Cuba participated little in these efforts of rising industry ; and what is very remarkable, in 1553, the historians of the Conquest $\dagger$ mention no exportation of sugar except that of Mexican sugar for Spain and Peru. Far from throwing into commerce what we now call colonial produce, the Havannah, till the eighteenth century, exported only skins and leather. The rearing of cattle was succeeded by the cultivation of tobacco and the rearing of bees, of which the first hives (colmenares) were brought from the Floridas. Wax and tobacco soon became more important objects of commerce than leather, but were shortly superseded in their turn by the sugar-cane and coffee. The cultivation of these productions did not exclude more ancient cultivation; and, in the different phases of agricultural industry, notwithstanding the general tendency to make the coffee plantations predominate, the sugar-houses furnish the greatest amount in the annual profits. The exportation of tobacco, coffee, sugar, and wax, by lawful and

[^437]illicit means, amounts to fourteen millions of piastres, according to the actual price of those articles.

Three qualities of sugar are distinguished in the island of Cuba, according to the degree of purity attained by refining (grados de purga). In every loaf or reversed cone, the upper part yields the white sugar; the middle part the yellow sugar, or quebrado; and the lower part, or point of the cone, the cucurucho. All the sugar of Cuba is consequently refined; a very small quantity is introduced of coarse or muscovado sugar (by corruption, azucar mascabado). The forms being of a different size, the loaves (panes) differ also in weight. They generally weigh an arroba after refining. The refiners (maestros de azucar) endeavour to make every loaf of sugar yield five-ninths of white, three-ninths of quebrado, and one-ninth of cucurucho. The price of white sugar is higher when sold alone, than in the sale called surtido, in which three-fifths of white sugar and two-fifths of quebrado are combined in the same lot. In the latter case the difference of the price is generally four reals (reales de plata) ; in the former, it rises to six or seven reals. The revolution of Saint Domingo, the prohibitions dictated by the Continental System of Napoleon, the enormous consumption of sugar in England and the United States, the progress of cultivation in Cuba, Brazil, Demerara, the Mauritius, and Java, have occasioned great fluctuations of price. In an interval of twelve years, it was from three to seven reals in 1807, and from twenty-four to twenty-eight reals in 1818, which proves fluctuations in the relation of one to five.

During my stay in the plains of Guines, in 1804, I endeavoured to obtain some accurate information respecting the statistics of the making of cane-sugar. A great yngenio producing from 32,000 to 40,000 arrobas of sugar, is generally fifty caballerias,* or 650 hectares in extent, of which the half (less than one-tenth of a square sea league) is alloited to sugar-making properly so called (cañaveral), and the other

[^438]half for alimentary plants and pasturage (potrero). The price of land varies, naturally, according to the quality of the soil, and the proximity of the ports of the Havannah, Mantanzas, and Mariel. In a circuit of twenty-five leagues round the Havannah, the caballeria may be estimated at two or three thousand piastres. For a produce* of 32,000 arrobas (or 2000 cases of sugar), the yngenio must hare at least three hundred negroes. An adult and acclimated slave is worth from four hundred and fifty to five hundred piastres; a bozal negro, adult, not acclimated, three hundred and seventy to four hundred piastres. It is probable that a negro costs annually, in nourishment, clothing, and medicine, forty-five to fifty piastres; consequently, with the interest of the capital, and deducting the holidays, more than twentytwo sous per day. The slaves are fed with tasajo (meat dried in the sun) of Buenos Ayres and Caracas; salt-fish (bacalao), when the tasajo is too dear; and vegetables (viandas), such as pumpkins, muñatos, batatas, and maize. An arroba of tasajo was worth ten to twelve re. ls at Guines, in 1804; and from fourteen to sixteen in 1825. An yngenio, such as we here suppose (with a produce of 32,000 to 40,000 arrobas), requires, 1st, three machines with cylinders put in motion by oxen (trapiches), or two water-wheels; 2nd, according to the old Spanish method, which, by a slow fire causes a great consumption of wood, eighteen cauldrons (piezas); according to the first method of reverberation (introduced since the year 1801 by Mr. Bailli of Saint Domingo, under the auspices of Don Nicolas Calvo,) three clarificadoras, three peilas, and two traines de tachos (each train has three piezas), in all twelve fondos. It is commonly asserted, that three arrobas of refined sugar, yield one barrel of miel, and that the molasses are sufficient for the

[^439]expences of the plantation : this is especially the case where they produce brandy in abundance. Thirty-two thousand arrobas of sugar yield 15,000 bariles de miel (at two arrobas), of which five hundred pipas de aguardiente de cana are made, at twenty-five piastres.

In establishing an yngenio capable of furnishing two thousand caxas yearly, a capitalist would draw, according to the old Spanish method, and at the present price of sugar, an interest of six and one-sixth per cent. ; an interest no way considerable for an establishment not merely agricultural, and of which the expense remains the same, although the produce sometimes diminishes more than a third. It is very rarely that one of those great yngenios can make 32,000 cases of sugar during several successive years. It cannot therefore be matter of surprise that when the price of sugar in the island of Cuba has been very low (four or five piastres the quintal), the cultivation of rice has been preferred to that of the sugar-cane. The profit of the old landowners (haciendados) consists, 1st, in the circumstance that the expenses of the settlement were much less twenty or thirty years ago, when a caballeria of good land cost only 1200 or 1600 piastres, instead of 2500 to 3000 ; and the adult negro 300 piastres, instead of 450 to 500 ; 2nd, in the balance of the very low and the very high prices of sugar. These prices are so different in a period of ten years, that the interest of the capital varies from five to fifteen per cent. In the year 1804, for instance, if the capital employed had been only 400,000 piastres, the raw produce, according to the value of sugar and rum, would have amounted to 94,000 piastres. Now, from 1797 to 1800 , the price of a case of sugar was sometimes, mean value, forty piastres instead of twentyfour, which I was obliged to suppose in the calculation for the year 1825. When a sugar-house, a great manufacture, or a mine, is found in the hands of the person who first formed the establishment, the estimate of the rate of interest which the capital employed yields to the proprietor, can be no guide to those who, purchasing afterwards, balance the advantages of different kinds of industry.

In soils that can be watered, or where plants with tuberose roots have preceded the cultivation of the sugarcane, a caballeria of fertile land yields, instead of 1500
arrobas, 3000 or 4000 , making 2660 or 3340 kilogrammes of sugar (blanco and quebrado) per hectare. In fixing on 1500 arrobas, and estimating the case of sugar at 24 piastres, according to the price of the Havannah, we find that the hectare produces the value of 870 francs in sugar; and that of 288 francs in wheat, in the supposition of an octuple harvest, and the price of 100 kilogrammes of wheat being 18 francs. I have observed elsewhere, that in this comparison of the two branches of cultivation, it must not be forgotten that the cultivation of sugar requires great capital ; for instance, at present 400,000 piastres for an annual production of 32,000 arrobas, or 368,000 kilogrammes, if this quantity be made in one single settlement. At Bengal, in watered lands, an acre ( 4044 square metres) renders 2300 kilogrammes of coarse sugar, making 5,700 kilogrammes per hectare. If this fertility is common in lands of great extent, we must not be surprised at the low price of sugar in the East Indies. The produce of a hectare is double that of the best soil in the West Indies, and the price of a free Indian day-labourer, is not one-third the price of the day-labour of a negro slave in the island of Cuba.

In Jamaica, in 1825, a plantation of five hundred acres (or fifteen and a half caballerias), of which two hundred acres are cultivated in sugar-cane, yields, by the labour of two hundred slaves, one hundred oxen, and fifty mules, 2800 cwt., or 142,200 kilogrammes of sugar, and is computed to be worth, with its, slaves, 43,000 l. sterling. According to this estimate of Mr. Stewart, one hectare would yield 1760 kilogrammes of coarse sugar; for such is the quality of the sugar furnished for commerce at Jamaica. Reckoning in a great sugar-fabric of the Havannah 25 caballerias or 325 hectares for a produce of from 32,000 to 40,000 cases, we find 1130 or 1420 kilogrammes of refined sugar (blanco and quebrado) per hectare. This result agrees sufficiently with that of Jamaica, if we consider the loss sustained in the weight of sugar by refining, in converting the coarse sugar into azucar blanco y quebrado) or refined sugar. At San Domingo, a square ( 3403 square toises $=1.29$ hectare) is estimated at forty, and sometimes at sixty quintals: if we fix on 5000 pounds, we still find 1900 kilogrammes of coarse sugar per hectare. Supposing,
as we ought to do when speaking of the produce of the whole island of Cuba, that, in soils of average fertility, the caballeria (at 13 hectares) yields 1500 arrobas of refined sugar (mixed with blanco and quebrado), or 1330 kilogrammes per hectare, it follows that 60,872 hectares, or nineteen five-fourths square sea leagues, (nearly a ninth of the extent of a department of France of middling size), suffice to produce the 440,000 cases of refined sugar, furnished by the island of Cuba for its own consumption and for lawful and illicit exportation. It seems surprising that less than twenty square sea leagues should yield an annual produce of more than the value of fifty-two millions of francs (counting one case, at the Havannah, at the rate of twenty-four piastres). To furnish coarse sugar for the consumption of thirty millions of French, (which is actually from fifty-six to suxty millions of kilogrammes,) it requires within the tropics, but nine and five-sixths square sea leagues cultivated with sugar-cane; and in temperate climates, but thirty-seven and a half square sea leagues cultivated with beet-root. A hectare of good soil, sown or planted with beet-root, produces in France from ten to thirty thousand kilogrammes of beet-root. The mean fertility is 20,000 kilogrammes, which furnish $2 \frac{1}{2}$ per cent., or five hundred kilogrammes of coarse sugar. Now, one hundred kilogrammes of that sugar yield fifty kilogrammes of refined sugar, thirty of sugar vergeoise, and twenty of muscovade; consequently, a hectare of beet-root produces 250 kilogrammes of refined sugar.

A short time before my arrival at the Havannah, there had been sent from Germany some specimens of beet-root sugar, which were said "to menace the existence of the Sugar Islands in America." The planters had learned with alarm that it was a substance entirely similar to sugar-cane, but they flattered themselves that the high price of labour in Europe, and the difficulty of separating the sugar fit for crystallization from so great a mass of vegetable pulp, would render the operation on a grand scale little profitable. Chemistry has, since that period, succeeded in overcoming those difficulties; and, in the year 1812, France alone had more than two hundred beet-root sugar factories working with very unequal success, and producing a million
of kilogrammes of coarse sugar, that is, a fifty-eighth part of the actual consumption of sugar in France. Those two hundred factories are now reduced to fifteen or twenty, which yield a produce of 300,000 kilog.* The inhabitants of the West Indies, well informed of the affairs of Europe, no longer fear beet-root, grapes, chesnuts, and mushrooms, the coffee of Naples, nor the indigo of the south of France. Fortunately, the improvement of the condition of the West India slaves does not depend on the success of these branches of European cultivation.

Previously to the year 1762 the island of Cuba did not furnish more commercial produce, than the three least industrious and most neglected provinces with respect to cultivation, Veragua, the isthmus of Panama, and Darien, do at present. A political event which appeared extremely unfortunate, the taking of the Havannah by the English, roused the public mind. The town was evacuated in 1784, and its subsequent efforts of industry date from that memorable period. The construction of new fortifications on a gigantic plant threw a great deal of money suddenly into circulation; later, the slave-trade became free, and furnished hands for the sugar factories. Free trade with all the ports of Spain, and occasionally with neutral states, the able administration of Don Luis de Las Casas, the establishment of the Consulado and the Patriotic Society, the destruction of the French colony of Saint Domingo, $\ddagger$

* Although the actual price of cane-sugar not refined, is 1 fr. 50 cent. the kilogramme, in the ports, the production of beetroot-sugar offers a still greater advantage in certain localities, for instance, in the vicinity of Arras. These establishments would be introduced in many other parts of France, if the price of the sugar of the West Indies rose to 2 francs, or 2 francs 25 cents the kilogramme, and if the government laid no tax on the beet-root-sugar, to compensate the loss on the consumption of colonial sugar. The making of beetroot-sugar is especially profitable when combined with a general system of rural economy, with the improvement of the soil, and the nourishment of cattle : it is not a cultivation independent of local circumstances, like that of the sugar-cane in the tropics.
+ It is affirmed, that the construction of the fort of Cabafia alone, cost fourteen millions of piastres.
$\ddagger$ In three successive attempts, in August 1791, June 1793, and October 1803. Above all, the unfortunate and sanguinary expedition of Generals Leclerc and Rochambeau, completed the destruction of the sugar factories of Saint Domingo.
and the rise in the price of sugar which was the natural consequence, the improvement in machines and ovens, due in great part to the refugees of Cape François, the more intimate connection formed between the proprietors of the sugar factories and the merchants of the Havannah, the great capital employed by the latter in agricultural establishments (sugar and coffee plantations), such have been successively the causes of the increasing prosperity of the island of Cuba, notwithstanding the conflict of the authorities, which serves to embarrass the progress of affairs.

The greatest changes in the plantations of sugar-cane and in the sugar factories, took place from 1796 to 1800. First, mules were substituted (trapiches de mulas) for oxen (trapiches de bueyes); and afterwards, hydraulic wheels were introduced (trapiches de agua), which the first conquistadores had employed at Saint Domingo; finally, the action of steam-engines was tried at Ceibabo, at the expense of Count Jaruco y Mopex. There are now twenty-five of those machines in the different sugar mills of the island of Cuba. The culture of the sugar-cane of Otaheite in the meantime increased. Boilers of preparation (clarificadoras) were introduced, and the reverberating furnaces better arranged. It must be said, to the honour of wealthy proprietors, that in a great number of plantations, a kind solicitude is manifested for sick slaves, for the introduction of negresses, and for the education of children.

The number of sugar factories (yngenios), in 1775, was 473 in the whole island; and in 1817 more than 780. Among the former, none produced the fourth part of the sugar now made in the yngenios of second rank; it is consequently not the number of factories that can afford an accurate idea of the progress of that branch of agricultural industry.

The first sugar-canes carefully planted on virgin soil yield a harvest during twenty to twenty-five years, after which they must be replanted every three years. There existed in 1804, at the Hacienda de Matamoros, a square (cañaveral) worked during forty-five years. The most fertile soil for the production of sugar is now in the vicinity of Mariel and Guanajay. That variety of sugar-cane known by the name
of Caña de Otahiti, recognised at a distance by a fresher green, has the advantage of furnishing, on the same extent of soil, one-fourth more juice, and a stem more woody, thicker, and consequently richer in combustible matter. The refiners (maestros de azucar), pretend that the vezou (guarapo) of the Caña de Otahiti is more easily worked, and yields more crystallized sugar by adding less lime or potass to the vezou. The South Sea sugar-cane furnishes, no doubt, after five or six years' cultivation, the thinnest stubble, but the knots remain more distant from each other than in the Caña creolia or de la tierra. The apprehension at first entertained of the former degenerating by degrees into ordinary sugar-cane is happily not realized. The sugarcane is planted in the island of Cuba in the rainy season, from July to October; and the harvest is gathered from February to May.

In proportion as by too rapid clearing the island has become unwooded, the sugar-houses have begun to want fuel. A little stalk (sugar-cane destitute of its juice) used to be employed to quicken the fire beneath the old cauldrons (tachos); but it is only since the introduction of reverberating furnaces by the emigrants of Saint Domingo, that the attempt has been made to dispense altogether with wood, and burn only refuse sugar-cane. In the old construction of furnaces and cauldrons, a tarea of wood, of one hundred and sixty cubic feet, is burnt to produce five arrobas of sugar, or, for a hundred kilogrammes of raw sugar, 278 cubic feet of the wood of the lemon and orange trees are required. In the reverberating furnaces of Saint Domingo, a cart of refuse-cane of 495 cubic feet produced 640 pounds of coarse sugar, which make 158 cubic feet of refuse-cane for 100 kilogrammes of sugar. I attempted, during my stay at Guines, and especially at Rio Blanco, with the Count de Mopex, several new constructions, with the view of diminishing the expense of fuel, surrounding the focus with substances which do not powerfully conduct the heat, and thus diminish the sufferings of the slaves who keep up the fire. Along residence in the salt-producing districts of Europe, and the labours of practical halurgy, to which I have been devoted since my early youth, suggested to me the idea of those constructions, which have been imitated with some success. Cuver-
cles of wood, placed on clarificadoras, accelerated the evaporation, and led me to believe that a system of cuvercles and moveable frames, furnished with counter-weights, might extend to other cauldrons. This object merits further examination; but the quantity of vezou (guarapo), of the crystallized sugar extracted, and that which is destroyed, the fuel, the

- time, and the pecuniary expense, must be carefully estimated.

An error, very general through Europe, and one which influences opinion respecting the effects of the abolition of the slave-trade is, that in those West India islands called sugar colonies, the majority of the slaves are supposed to be employed in the production of sugar. The cultivation of the sugar-cane is no doubt a powerful incentive to the activity of the slave trade; but a very simple calculation suffices to prove that the total mass of slaves contained in the West Indies is nearly three times greater than the number employed in the production of sugar. I showed, seven years ago, that, if the 200,000 cases of sugar exported from the island of Cuba, in 1812, were produced in the great establishments, less than 30,000 slaves would have sufficed for that kind of labour. It ought to be borne in mind for the interests of humanity, that the evils of slavery weigh on a much greater number of individuals than agricultural labours require, even admitting, which I am very far from doing, that sugar, coffee, indigo, and cotton, can be cultivated only by slaves. At the island of Cuba it is generally supposed that one hundred and fifty negroes are required to produce 1000 cases ( 184,000 kilog.) of refined sugar; or, in round numbers, a little more than 1200 kilog. by the labour of each adult slave. The production of 440,000 cases would consequently require only 66,000 slaves. If we add 36,000 to that number, for the cultivation of coffee and tobacco in the island of Cuba, we find that about 100,000 of the 260,000 slaves now there, would suffice for the three great branches of colonial industry on which the activity of commerce depends.

Corfee.-The cultivation of coffee takes its date, like the improved construction of cauldrons in the sugar houses, from the arrival of the emigrants of San Domingo, especially after the years 1796 and 1798. A hectare yields 860 kilog.
the produce of 3500 plants. The province of the Havannah reckoned:

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In 1800 - • - 60 cafetales.
In 1817 - • • 779
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The coffee tree being a shrub that yields a good harvest only in the fourth year, the exportation of coffee from the port of the Havannah was, in 1804, only 50,000 arrobas. It rose

$$
\begin{aligned}
& \text { In } 1809 \text { to • • . } 320,000 \text { arrobas. } \\
& \text { In } 1815 \quad . \quad . \quad 918,263
\end{aligned}
$$

In 1815, when the price of coffee was fifteen piastres the quintal, the value of the exportation from the Havannah exceeded the sum of $3,443,000$ piastres. In 1823, the exportation from the port of Matanzas was 84,440 arrobas; so that it seems not doubtful, that in years of medium fertility, the total exportation of the island, lawful and contraband, is more than fourteen millions of kilogrammes.

From this calculation it results, that the exportation of coffee from the island of Cuba is greater than that from Java, estimated by Mr. Crawfurd, in 1820, at 190,000 piculs, $11 \frac{4}{5}$ millions of kilogrammes. It likewise exceeds the exportation from Jamaica, which amounted, in 1823, according to the registers of the custom-house, only to 169,734 cwt., or $8,622,478$ kilogrammes. In the same year, Great Britain received, from all the English islands, 194,820 cwt., or $9,896,856$ kilogrammes; which proves that Jamaica only produced six-sevenths. Guadaloupe sent, in 1810, to the mother country, 1,017,190 kilogrammes; Martinico, 671,336 kilogrammes. At Hayti, where the production of coffee before the French revolution was $37,240,000$ kilogrammes, Port-au-Prince exported, in 1824, only $91,544,000$ kilogrammes. It appears that the total exportation of coffee from the archipelago of the West Indies by lawful means only, now amounts to more than thirty-eight millions of kilogrammes; nearly five times the consumption of France, which, from 1820 to 1823, was, on the yearly average, $8,193,000$ kilogrammes. The consumption of Great Britain is yet* only $3 \frac{1}{2}$ millions of kilogrammes.

[^440]The exportation of 1814 was $60 \frac{1}{2}$ millions of kilogrammes, which we may suppose was at that period nearly the consumption of the whole of Europe. Great Britain (taking that denomination in its true sense, as denoting only England and Scotland), now consumes nearly two-thirds less coffee, and three times more sugar than France.

The price of sugar at the Havannah is always by the árroba of 25 Spanish pounds (or 11.49 kilogrammes), and the price of coffee by the quintal (or 45.97 kilogrammes). The latter has been known to vary from 4 to 30 piastres; it even fell, in 1808, below 24 reals. The price of 1815 and 1819 was between 13 and 17 piastres the quintal; coffee is now at 12 piastres. It is probable that the cultivation of coffee scarcely employs in the whole island of Cuba 28,000 slaves, who produce, on the yearly average. 305,000 Spanish quintals ( 14 millions of kilogrammes), or, according to the present value, $3,660,000$ piastres; while 66,000 negroes produce 440,000 cases ( 81 millions of kilogrammes) of sugar, which, at the price of 24 piastres, is worth $10,560,000$ piastres. It results from this calculation, that a slave now produces the value of 130 piastres of coffee, and 160 piastres of sugar. It is almost useless to observe, that these relations vary with the price of the two articles, of which the variations are often opposite, and that, in calculations which may throw some light on agriculture in the tropical region, I comprehend in the same point of view, interior consumption, exportation lawful and contraband.

Tobacco.-The tobacco of the island of Cuba is celebrated throughout Europe. The custom of smoking, borrowed from the natives of Hayti, was introduced into Europe about the end of the sixteenth and beginning of the seventeenth century. It was generally hoped that the cultivation of tobacco, freed from an oppressive monopoly, would be to the Havannah a very profitable object of commerce. The good intentions displayed by the government in abolishing, within six years, the Factoria de tabacos,
kilogrammes) ; in 1809, it rose to $45,071 \mathrm{cwt}$. ; in 1810, to 49,147 cwt. ; in 1823, to $71,000 \mathrm{cwt}$; in 1824, to $66,000 \mathrm{cwt}$. (or 3,552,800 kilogrammes.)
have not been attended by the improvement which was expected in that branch of industry. The cultivators want capital, the farms have become extremely dear, and the predilection for the cultivation of coffee is prejudicial to that of tobacco.

The oldest information we possess respecting the quantity of tobacco which the island of Cuba has thrown into the magazines of the mother country, go back to 1748. According to the Abbe Raynal, a much more exact writer than is generally believed, that quantity, from 1748 to 1753 (everage year) was 75,000 arrobas. From 1789 to 1794, the produce of the island amounted annually to 250,000 arrobas; but from that period to 1803, the increased price of land, the attention given exclusively to the coftee plantations, and the sugar factories, little vexations in the exercise of the royal monopoly (estanco), and impediments in the way of export trade, have progressively diminished the produce by more than one-half. The total produce of tobaceo in the island, is, however, believed to have been, from 1822 to 1825, again from 300,000 to 400,000 arrobas.
In good years, when the harvest rose to 350,000 arrobas of leaves, 128,000 arrobas were prepared for the Peninsula, 80,000 for the Havannah, 9200 for Peru, 6000 for Panama, 3000 for Buenos Ayres, 2240 for Mexico, and 1000 for Caracas and Campeachy. To complete the sum of $315,000,000$ (for the harvest loses 10 per cent. of its weight in merma $y$ aberias, during the preparation and the transport), we must suppose that 80,000 arrobas were consumed in the interior of the island (en los campos), whither the monopoly and the taxes did not extend. The maintenance of 120 slaves and the expense of the manufacture amounted only to 12,000 piastres annually; the persons employed in the factoria cost 54,100 piastres. The value of 128,000 arrobas, which in good years was sent to Spain, either in cigars or in snuff (rama y polvos), often exceeded $5,000,000$ piastres, according to the common price of Spain. It seems surprising to see that the statements of exportation from the Havannah (documents published by the Consulado) mark the exportations for 1816, at only 3400 arrobas; for 1823, only 13,900 arrobas of tabaco en rama, and 71,000 pounds of tabaco torcida, estimated together, at the custom-house, at 281,000
piastres ; for 1825, only 70,302 pounds of cigars, and 167,100 pounds of tobacco in leaves; but it must be remembered that no branch of contraband is more active than that of cigars. Although the tobacco of the Vuelta de abaxo is the most famous, a considerable exportation takes place in the eastern part of the island. I rather doubt the total exportation of 200,000 boxes of cigars (value 2,000,000 piastres), as stated by several travellers during latter years. If the harvests were thus abundant, why should the island of Cubs receive tobacco from the United States for the consumption of the lower class of people?

I shall say nothing of the cotton, the indigo, or the wheat of the island of Cuba. These branches of colonial industry are of comparatively little importance; and the proximity of the United States and Guatimala renders competition almost impossible. The state of Salvador, belonging to the Confederation of Central America, now throws 12,000 tercios annually, or $1,800,000$ pounds of indigo into trade; an exportation which amounts to more than $2,000,000$ piastres. The cultivation of wheat succeeds (to the great astonishment of travellers who have passed through Mexico), near the Quatro Villas, at small heights above the level of the ocean, though in general it is very limited. The flour is fine; but colonial productions are more tempting, and the plains of the United States-that Crimea of the New World -yield harvests too abundant for the commerce of native cereals to be efficaciously protected by the prohibitive system of the custom-house, in an island near the moutb of the Mississippi and the Delaware. Analogous difficulties oppose the cultivation of flax, hemp, and the vine. Possibly the inhabitants of Cuba are themselves ignorant of the fact that, in the first years of the conquest by the Spaniards, wine was made in their island of wild grapes.* This kind of vine, peculiar

[^441]to America, has given rise to the general error, that the true Vitis vinifera is common to the two continents. The Parras monteses which yields "the somewhat sour wine of the island ot Cuba," was probably gathered on the Vitis tiliafolia which Mr. Willdenouw has described from our herbals. In no part of the northern hemisphere has the vine hitherto been cultivated with the view of producing wine, south of the $27^{\circ} 48^{\prime}$, or the latitude of the island of Ferro, one of the Canaries, and of $29^{\circ} 2^{\prime}$, or the latitude of Bushire in Persia.

Wax.-This is not the produce of native bees (the Melipones of Latreille), but of bees brought from Europe by way of Florida. The trade in wax has only become important since 1772. The exportation of the whole island, which from 1774 to 1779 was only 2,700 arrobas (average year), was estimated in 1803, including contraband, at 42,700 arrobas, of which 25,000 were destined for Vera Cruz. In the churches of Mexico there is a great consumption of Cuban wax. The price varies from sixteen to twenty piastres the arroba.

Trinidad and the small port of Baracoa also carry on a considerable trade in wax, furnished by the almost uncultivated regions on the east of the island. In the proximity of the sugar-factories many bees perish of inebriety from the molasses, of which they are extremely tond. In general the production of wax diminishes in proportion as the cultivation of the land augments. The exportation of wax, according to the present price, amounts to about 500,000 of piastres.

Commerce.-It has already been observed, that the importance of the commerce of the island of Cuba depends not solely on the riches of its productions, the wants of the population in the articles and merchandize of Europe, but also in great part on the favourable position of the port of the Havanuah. This port is situated at the entrance of the
added something to the analogies of the woman-serpent, the confict of two brothers, the cataclysm of water, the raft of Coxcox, the exploring bird, and many other things that teach us incontestably that there existed a community of antique traditions between the nations of the two worlds? (Views of the Cordilleras and Monuments of America.)

Gulf of Mexico, where the high roads of the commercial nations of the old and the new worlds cross each other. It was remarked by the Abbé Raynal, at a period when agriculture and industry were in their infancy, and scarcely threw into commerce the value of $2,000,000$ piastres in sugar and tobacco, "that the island of Cuba alone might be worth a kingdom to Spain." There seems to have been something prophetic in those memorable words; and since the parent state has lost Mexico, Peru, and so many other colonies declared independent, they demand the serious consideration of statesmen who are called upon to discuss the political interests of the Peninsula.

The island of Cuba, to which for a long time the court of Madrid wisely granted great freedom of trade, exports, lawfully and by contraband, of its own native productions, in sugar, coffee, tobacco, wax, and skins, to the value of more than $14,000,000$ piastres; which is about one-third less than the value of the precious metals furnished by Mexico at the period of the greatest prosperity of its mines.* It may be said that the Havannah and Vera Cruz are to the rest of America what New York is to the United States. The tonnage of 1000 to 1200 merchant ships which annually enter the port of the Havannah, amounts (excluding the small coasting-vessels), to 150,000 or 170,000 tons. $\dagger$ In time of peace, from 120 to 150 ships of war are frequently seen at anchor at the Havannah. From 1815 to 1819, the productions registered at the custom-house of that port only (sugar, rum, molasses, coffee, wax, and butter) amounted, on the average, to the value of $11,245,000$ piastres per annum. In 1823, the exportation registered two-thirds less than their actual price, amounted (deducting $1,179,000$ piastres in specie) to more than $12,500,000$ piastres. It is probable

* In 1805, gold and silver specie was struck at Mexico, to the value of $27,165,888$ piastres; but, taking an average of ten years of political tranquillity, we find from 1800 to 1810 , scarcely $24 \frac{1}{2}$ million of piastres.
$\dagger$ In 1816, the tonnage of the commerce of New York was 299,617 tons; that of Boston, 143,420 tons. The amount of tonnage is not always an exact measure of the wealth of commerce. The countries which export rice, flour, hewn wood, and cotton, require more capaciousness than the tropical regions, of which the productions (cochineal, indigo, sugar, and coffee) are of little bulk, although of considerable value.
that the importations of the whole island (lawful and contraband), estimated at the real price of the articles, the merchandize and the slaves, amount at present to $15,000,000$ or $16,000,000$ piastres, of which scarcely $3,000,000$ or $4,000,000$ are re-exported. The Havannah purchases from abroad far beyond its own wants, and exchanges its colonial articles for the productions of the manufactures of Europe, to sell a part of them at Vera Cruz, Truxillo, Guayra, and Carthagena.

On comparing, in the commercial tables of the Havannah, the great value of merchandise imported, with the little value of merchandise re-exported, one is surprised at the vast internal consumption of a country containing only 325,000 whites and 130,000 free men of colour. We find, in estimating the different articles, according to the real current prices: in cotton and linen (bretañas, platillas, lienzos $y$ hilo), two and a half to three millions of piastres; in tissues of cotton (zarazas musulinas), one million of piastres ; in silk (rasos y generos de seda), 400,000 piastres ; and in linen and woollen tissues, 220,000 piastres. The wants of the island, in European tissues, registered as exported to the port of the Havannah only, consequently exceeded, in these latter years, from four millions to four and a half millions of piastres. To these importations of the Havannah we must add: hardware and furniture, more than half a million of piastres; iron and steel, 380,000 piastres; planks and great timber, 400,000 piastres; Castile soap, 300,000 piastres. With respect to the importation of provisions and drinks to the Havannah, it appears to me to be well worthy the attention of those who would know the real state of those societies which are called sugar or slave colonies. Such is the composition of those societies established on the most fruitful soil which nature can furnish for the nourishment of man, such the direction of agricultural labours and industry in the West Indies, that, in the best climate of the equinoctial region, the population would want subsistence but for the treedom and activity of external commerce. I do not speak of the introduction of wines at the port of the Havannah, which amounted (according to the registers of the custom-house), in 1803, to 40,000 barrels; in 1823 , to 15,000 pipas and 17,000 barrels, to the value of $1,200,000$ piastres ; nor of the intro-
duction of 6000 barrels of brandy from Spain and Holland, and 113,000 barrels ( $1,864,000$ piastres) of flour. These wines, liquors, and flour, are consumed by the opulent part of the nation. The cereals of the United States have become articles of absolute necessity, in a zone where maize, manioc, and bananas, were long preferred to every other amylaceous food. The development of a luxury altogether European, cannot be complained of amidst the prosperity and increasing civilization of the Havannah; but, along with the introduction of the flour, wine, and spirituous liquors of Europe, we find, in the year 1816, $1 \frac{1}{2}$ millions of piastres; and, in the year 1823, $3 \frac{1}{2}$ millions for salt meat, rice, and dried vegetables. In the last mentioned year, the importation of rice was 323,000 arrobas; and the importation of dried and salt meat (tasajo), for the slares, 465,000 arrobas.

The scarcity of necessary articles of subsistence characterizes a part of the tropical climates, where the imprudent activity of Europeans has inverted the order of nature : it will diminish in proportion as the inhabitants, more enlightened respecting their true interests, and discouraged by the low price of colonial produce, will vary the cultivation, and give free scope to all the branches of rural economy. The principles of that narrow policy which guides the government of very small islands, inhabited by men who desert the soil whenever they are sufficiently enriched, cannot be applicable to a country of an extent nearly equal to that of England, covered with populous cities, and where the inhabitants, established from father to son during ages, far from regarding themselves as strangers to the American soil, cherish it as their own country. The population of the island of Cuba, which in fifty years will perhaps exceed a million, may open by its own consumption an immense field to native industry. If the slave-trade should cease altogether, the slaves will pass by degrees into the class of free men; and society, being reconstructed, without suffering any of the violent convulsions of civil dissension, will follow the path which nature has traced for all societies that become numerous and enlightened. The cultivation of the sugar-cane and of coffee will not be abandoned; but it will no longer remain the principal basis of national existence than the
cultivation of cochineal in Mexico, of indigo in Guatimala, and of cacao in Venezuela. A free, intelligent, and agricultural population, will progressively succeed a slave population, destitute of foresight and industry. Already the capital which the commerce of the Havannah has placed within the last twenty-five years in the hands of cultivators, has began to change the face of the country; and to that power, of which the action is constantly increasing, another will be necessarily joined, inseparable from the progress of industry and national wealth,-the development of human intelligence. On these united powers depend the future destinies of the metropolis of the West Indies.

In reference to what has been said respecting external commerce, I may quote the author of a memoir which I have often mentioned, and who describes the real situation of the island. "At the Havannah, the effects of accumulated wealth begin to be felt; the price of provisions has been doubled in a small number of years. Labour is so dear, that a bozal negro, recently brought from the coast of Africa, gains by the labour of his hands (without having learned any trade), from four to five reals (two francs thirteen sous to three francs five sous) a day. The negroes who follow mechanical trades, however common, gain from five to six francs. The patrician families remain fixed to the soil : a man who has enriched himself, does not return to Europe taking with him his capital. Some families are so opulent, that Don Matheo de Pedroso, who died lately, left in landed property above two millions of piastres. Several commercial houses of the Havannah purchase, annually, from ten to twelve thousand cases of sugar, for which they pay at the rate of from 350,000 to 420,000 piastres." (De la situacion presente de Cuba, in MS.) Such was the state of public wealth at the end of 1800. Twenty-five years of increasing prosperity have elapsed since that period, and the population of the island is nearly doubled. The exportation of registered sugar had not, in any year before 1800 , attained the extent of 170,000 cases ( $31,280,000$ kilograminns); in these latter times it has constantly surpassed 200,000 cases, and even attained 250,000 and 300,000 cases (forty-six to fifty-five millions of kilogrammes). A new branch of industry has sprung up (that of plantations
of the coffee tree), which furnishes an exportation of the value of three millions and a half of piastres. Industry, guided by a greater mass of knowledge, has been better directed. The system of taxation that weighed on national industry and exterior commerce, has been made lighter since 1791, and been improved by successive changes. Whenever the mother-country, mistaking her own interests, has attempted to make a retrograde step, courageous voices have arisen not only among the Havaneros, but often among the Spanish rulers, in defence of the freedom of American commerce. A new channel has recently been opened for capital, by the enlightened zeal and patriotic views of the intendant Don Claudio Martinez de Pinillos, and the commerce of entrepôt has been granted to the Havannah, on the most advantageous conditions.

The difficult and expensive interior communications of the island, render its own productions dearer at the ports, notwithstanding the short distance between the northern and southern coasts. A project of canalization, which unites the double advantage of connecting the Havannah and Batabano by a navigable line, and diminishing the high price of the transport of native produce, merits here a special mention. The idea of the Canal of Guines had been conceived for more than half a century, with the view of furnishing timber at a more moderate price for ship-building in the arsenal of the Havannah. In 1796, the Count de Jaruco y Mopox, an enterprising man, who had acquired great influence by his connection with the Prince of the Peace, undertook to revive this project. The survey was made in 1798, by two very able engineers, Don Francisco and Don Felix Lemaur. These officers ascertained that the canal in its whole development, would be nineteen leagues long ( 5000 varas or 4150 metres), that the point of partition would be at the Taverna del Rey, and that it would require nineteen locks on the -north, and twenty-one on the south. The distance from the Havannah to Batabano is only eight and a half sea-leagues. The canal of Guines would be very useful for the transport of agricultural productions by steam-boats,* because its

* Steam-boats are established from Havannah to Matanzas, and from the Havannah to Mariel. The government granted to Don Juan O'Farrill '(March 24th, 1819), a privilege on the barcos de vapor.
course would be in proximity with the best cultivated lands. The roads are nowhere worse in the rainy season than in this part of the island, where the soil is of friable limestone, little fitted for the construction of solid roads. The transport of sugar from Guines to the Havannah, a distance of twelve leagues, now costs one piastre per quiutal. Besides the advantage of facilitating internal communications, the canal would also give great importance to the surgidero of Batabano, into which small vessels laden with salt provisions (tasajo) from Venezuela, would enter without being obliged to double Cape Saint Antonio. In the bad season, and in time of war, when corsairs are cruizing between Cape Catoche, Tortucas, and Mariel, the passage from the Spanish main to the island of Cuba, would be shortened by entering, not at the Harannah, but at some port of the southern coast. The cost of constructing the canal de Guines, was estimated in 1796 at one million, or $1,200,000$ piastres: it is now thought that the expense would amount to more than one million and a half. The productions which might annually pass the canal, have been estimated at 75,000 cases of sugar, 25,000 arrobas of coffee, and 8000 bocoyes of molasses and rum. According to the first project, that of 1796 , it was intended to link the canal with the small river of Guines, to be brought from the Ingenio de la Holanda to Quibican, three leagues south of Bejucal and Santa Rosa. This idea is now relinquished, the Rio de los Guines losing its waters towards the east in the irrigation of the savannahs of Hato de Guanamon. Instead of carrying the canal east of the Barrio del Cerro, and south of the fort of Atarès, in the bay of the IIavannah, it was proposed at first to make use of the bed of the Chorrera or Rio Armendaris, from Calabazal to the Husillo, and then of the Zanja Real, not only for conveying the boats to the centre of the arrabales and of the city of the Havannah, but also for furnishing water to the fountains, which require to be supplied during three months of the year. I visited several times, with MM. Lemaur, the plains through which this line of navigation is intended to pass. The utility of the project is incontestible, if in times of great drought a sufficient quantity of water can be brought to the point of partition

At the Havannah, as in every place where commerce and
the wealth it produces increase rapidly, complaints are heard of the prejudicial influence exercised by them* on ancient manners. We cannot here stop to compare the first state of the island of Cuba, when covered with pasturage, before the taking of the capital by the English, and its present condition, since it has become the metropolis of the West Indies; nor to throw into the balance the candour and simplicity of manners of an infant society, against the manners that belong to the development of an advanced civilization. The spirit of commerce, leading to the love of wealth, no doubt brings nations to depreciate what money cannot obtain. But the state of human things is happily such, that what is most desirable, most noble, most free in man, is owing only to the inspirations of the soul, to the extent and amelioration of its intellectual faculties. Were the thirst of riches to take absolute possession of every class of society, it would infallibly produce the evil complained of by those who see with regret what they call the preponderance of the industrious system; but the increase of commerce, by multiplying the connections between nations, by opening an immense sphere to the activity of the mind, by pouring capital into agriculture, and creating new wants by the refinement of luxury, furnishes a remedy against the supposed dangers.

Finance.-The increase of the agricultural prosperity of the island of Cuba, and the influence of the accumulation of wealth on the value of importations, have raised the public revenue in these latter years, to four millions and a half, perhaps five millions of piastres. The custom-house of the Havannah, which before 1794, yielded less than 600,000 piastres, and from 1797 to $1800,1,900,000$ piastres, pours into the treasury, since the declaration of free trade, a revenue (importe liquido) of more than $3,100,000$ piastres.*

The island of Cuba as yet contains only one forty-second part of the population of France; and one half of its inhabitants, being in the most abject indigence, consume but little. Its revenue is nearly equal to that of the Republic

[^442]of Columbia, and it exceeds the revenue of all the customhouses of the United States* before the year 1795, when that confederation had $4,500,000$ inhabitants, while the island of Cuba contained only 715,000 . The principal source of the public revenue of this fine colony is the customhouse, which alone produces above three-fifths, and amply suffices for all the wants of the internal administration and military defence. If in these latter years, the expense of the general treasury of the Havannah amounted to more than four millions of piastres, this increase of expense is solely owing to the obstinate struggle maintained between the mother country and her freed colonies. Two millions of piastres were employed to pay the land and sea forces, which poured back from the American continent, by the Havannah, on their way to the Peninsula. As long as Spain, unmindful of her real interests, refuses to recognize the independence of the New Republics, the island of Cuba, menaced by Columbia and the Mexican Confederation, must support a military force for its external defence, which ruins the colonial finances. The Spanish naval force stationed in the port of the Havannah, generally costs above 650,000 piastres. The land forces require nearly one million and a half of piastres. Such a state of things cannot last indefinitely, if the $\mathrm{Pe}-$ ninsula do not relieve the burden that presses upon the colony.

From 1789 to 1797, the produce of the custom-house at the Havannah, never rose to more than 700,000 piastres. In 1814 it was $1,855,117$. From 1815 to 1819, the royal taxes, in the port of the Havannah, amounted to 11,575,460 piastres ; total $18,284,807$ piastres ; or, average year, $3,657,000$ piastres, of which the municipal taxes formed 36 .

The public revenue of the Administracion general de Rentas of the jurisdiction of the Havannah, amounted in


[^443]The royal and municipal taxes of importation at the custom-house of the Havannah, in 1823, were 2,734,563 piastres.

The total amount of the revenue of the Havannah, in 1824, was $3,025,300$ piastres.

In 1825 the revenue of the town and jurisdiction of the Havannah, was $3,350,300$ piastres.

These partial statements shew that, from 1789 to 1824, ehe public revenue of Cuba has been increased sevenfold.

According to the estimates of the Cajas matrices, the public revenue, in 1822, was in the province of the Havannah alone, $4,311,862$ piastres; which arose from the customhouse ( $3,127,918$ piastres), from the ramos de directa entrada, as lottery, tithes, \&c. ( 601,808 piastres), and anticipations on the charges of the Consulado and the Deposito ( 581,978 piastres). The expenditure in the same year, for the island ot Cuba, was 2,732,738 piastres, and for the succour destined to maintain the struggle with the continental colonies declared independent, $1,362,029$ piastres. In the first class of expenditure we find $1,355,798$ piastres for the subsistence of the military forces kept up for the defence of the Havannah and the neighbouring places; and 648,908 piastres for the royal navy stationed in the port of the Havannah. In the second class of expense foreign to the local administration, we find $1,115,672$ piastres for the pay of 4234 soldiers, who, after having evacuated Mexico, Columbia, and other parts of the Continent formerly Spanish possessions, passed by the Havannah to return to Spain ; 164,000 piastres is the cost the defence of the castle of San Juan de Ulloa.

I here terminate the Political Essay on the island of Cuba, in which I have traced the state of that important Spanish possession, as it now is. My object has been to throw light on facts, and give precision to ideas, by the aid of comparisons and statistical tables. That minute investigation of facts is desirable at a moment when, on the one hand enthusiasm exciting to benevolent credulity; and on the other, animosities menacing the security of the new. republics, have given rise to the most vague and erroneous statements. I have as far as possible abstained from all reasoning on future chances, and on the probability of the changes
which external politics may produce in the situation of the West Indies. I have merely examined what regards the organization of human society; the unequal partition of rights and of the enjoyments of life; the threatening dangers which the wisdom of the legislator and the moderation of free men may ward off, whatever be the form of the government. It is for the traveller who has been an eyewitness of the suffering and the degradation of human nature, to make the complaints of the unfortunate reach the ear of those by whom they can be relieved. I observed the condition of the blacks in countries where the laws, the religion, and the national habits tend to mitigate their fate; yet I retained, on quitting America, the same horror of slavery which I had felt in Europe. In vain have writers of ability, seeking to veil barbarous institutions by ingenious turns of language, invented the expressions "negro peasants of the West Indies," "black vassalage," and "patriarchal protection:" that is profaning the noble qualities of the mind and the imagination, for the purpose of exculpating by illusory comparisons, or captious sophisms excesses which afflict humanity, and which prepare the way for violent convulsions. Do they think that they have acquired the right of putting down commiseration, by comparing* the condition of the

[^444]negroes with that of the serfs of the middle ages, and with the state of oppression to which some classes are still subjected in the north and east of Europe? These comparisons, these artifices of language, this disdainful impatience with which even a hope of the gradual abolition of slavery is repulsed as chimerical, are useless arms in the times in which we live. The great revolutions which the continent of America and the Archipelago of the West Indies have undergone since the commencement of the nineteenth century, have had their influence on public feeling and public reason, even in countries where slavery exists and is begining to be modified. Many sensible men, deeply interested in the tranquillity of the sugar and slave islands, feel that by a liberal understanding among the proprietors, and by judicious measures adopted by those who know the localities, they might emerge from a state of danger and uneasiness, which indolence and obstinacy serve only to increase.

Slavery is no doubt the greatest evil that afflicts human nature, whether we consider the slave torn from his family in his native country, and thrown into the hold of a slaveship,* or as making part of a flock of black men, parked on the soil of the West Indies; but for individuals there are degrees of suffering and privation. How great is the difference in the condition of the slave who serves in the house of a rich family at the Havannah or at Kingston, or one who works for himself, giving his master but a daily retribution, and that of the slave attached to a sugar estate! The threats employed to correct an obstinate negro, mark this scale of human privations. The coachman is menaced with the coffee plantation; and the slave working on the latter is menaced with the sugar house. The negro, who with his wife inhabits a separate hut, whose heart is warmed by those feelings

[^445]of affection which for the most part characterize the African race, finds that after his labour some care is taken of him amidst his indigent family, is in a position not to be compared with that of the insulated slave lost in the mass. This diversity of condition escapes the notice of those who have not had the spectacle of the West Indies before their eyes. Owing to the progressive amelioration of the state even of the captive caste in the island of Cuba, the luxury of the masters, and the possibility of gain by their work, have drawn more than eighty thousand slaves to the towns; and the manumission of them, favoured by the wisdom of the laws, is become so active as to have produced, at the present period, more than 130,000 free men of colour. By considering the individual position of each class, by recompensing, by the decreasing scale of privations, intelligence, love of labour, and the domestic virtues, the colonial administration will find the best means of improving the condition of the blacks. Philanthropy does not consist in giving "a little more saltfish, and some fewer lashes:" the real amelioration of the captive caste ought to extend over the whole moral and physical position of man.

The impulse may be given by those European governments which have a right comprehension of human dignity, and who know that whatever is unjust bears with it a germ of destruction; but this impulse, it is melancholy to add, will be powerless, if the union of the planters, if the colonial assemblies or legislatures, fail to adopt the same views, and to act by a well-concerted plan, having for its ultimate aim the cessation of slavery in the West Indies. Till then it will be in vain to register the strokes of the whip, to diminish the number that may be given at one time, to require the presence of witnesses, and to appoint protectors of slaves; all these regulations, dictated by the most benevolent intentions, are easily eluded : the isolated position of the plantations renders their execution impossible. They pre-suppose a system of domestic inquisition incompatible with what is understood in the colonies by the phrase "eatablished rights." The state of slavery cannot be altogether peaceably ameliorated, except by the simultaneous action of the free men (white men and coloured), residing in the West Indies; by colonial assemblies and legislatures; by the influence of VOL. III.
those who, enjoying great moral consideration among their countrymen, and acquainted with the localities, know how to vary the means of improvement conformably with the manners, habits, and the position of every island. In preparing the way for the accomplishment of this task, which ought to embrace a great part of the archipelago of the West Indies, it may be useful to cast a retrospective glance on the events by which the freedom of a considerable part of the human race was obtained in Europe in the middle ages. In order to ameliorate without commotion, new institutions must be made, as it were, to rise out of those which the barbarism of centuries has consecrated. It will one day seem incredible, that until the year 1826, there existed no law in the Great Antilles to prevent the sale of young infants, and their separation from their parents, or to prohibit the degrading custom of marking the negroes with a hot iron, merely to enable these human cattle to be more easily recognized. Enact laws to obviate the possibility of a barbarous outrage; fix, in every sugar estate, the proportion between the least number of negresses and that of the labouring negroes; grant liberty to every slave who has served fifteen years, to every negress who has reared four or five children; set them free on the condition of working a certain number of days for the profit of the plantation; give the slaves a part of the net produce, to interest them in the increase of agricultural riches;* fix a sum on the budget of the public funds, destined for the ransom of slaves, and the amelioration of their condition,-such are the most urgent objects for colonial legislation.

[^446]The Conquest, on the continent of Spanish America, and the slave-trade in the West Indies, in Brazil, and in the southern parts of the United States, have brought together the most heterogeneous elements of population. This strange mixture of Indians, whites, negroes, mestizos, mulattoes, and zambos, is accompanied by all the perils which violent and disorderly passion can engender, at those critical periods when society, shaken to its very foundations, begins a new era. At those junctures, the odious principle of the Colonial System, that of security, founded on the hostility of castes, and prepared during ages, has burst forth with violence. Fortunately the number of blacks has been so inconsiderable in the new states of the Spanish continent, that, with the exception of the cruelties exercised in Venezuela, where the royalist party armed their slaves, the struggle between the independents and the soldiers of the mother country was not stained by the vengeance of the captive population. The free men of colour (blacks, mulattoes, and mestizoes) have warmly espoused the national cause; and the copper-coloured race, in its timid distrust and passiveness, has taken no part in movements from which it must profit in spite of itself. The Indians, long before the revolution, were poor and free agriculturists; isolated by their language and manners, they lived apart from the whites. If, in contempt of Spanish laws, the cupidity of the corregidores and the tormenting system of the missionaries often restricted their liberty, that state of vexatious oppression was far different from personal slavery like that of the slavery of the blacks, or of the vassalage of the peasantry in the Sclavonian part of Europe. It is the small number of blacks, it is the liberty of the aboriginal race, of which America has preserved more than eight millions and a half without mixture of foreign blood, that characterizes the ancient continental possessions of Spain, and renders their moral and political situation entirely different from that of the West Indies, where, by the disproportion between the free men and the slaves, the principles of the Colonial System have been developed with more energy. In the West Indian archipelago, as in Brazil (two portions of America which contain near $3,200,000$ slaves), the fear of a reaction among the blacks, and the perils that surround
the whites, have been hitherto the most powerful causes of the security of the mother countries, and of the maintenance of the Portuguese dynasty. Can this security, from its nature, be of long duration? Does it justify the inertness of governments who neglect to remedy the evil while it is yet time? I doubt this. When, under the influence of extraordinary circumstances, alarm is mitigated, when countries in which the accumulation of slaves has produced in society the fatal mixture of heterogeneous elements, may be led, perhaps unwillingly, into an exterior struggle, civil dissensions will break forth in all their violence, and European families, innocent of an order of things which they have had no share in creating, will be exposed to the most imminent dangers.

We can never sufficiently praise the legislative wisdom of the new republics of Spanish America, which since their birth, have been seriously intent on the total extinction of slavery. That vast portion of the earth has, in this respect, an immense advantage over the southern part of the United States, where the whites, during the struggle with England, established liberty for their own profit, and where the slave population, to the number of $1,600,000$, augments still more rapidly than the whites.* If civilization, instead of extending, were to change its place; if, after great and deplorable convulsions in Europe, America, between Cape Hatteras and the Missouri, were to become the principal seat of the light of Christianity, what a spectacle would be presented by that centre of civilization, where, in the sanctuary of liberty, we could attend a sale of negroes after the death of a master, and hear the sobbings of parents who are separated from their children! Let us hope that the generous principles which have so long animated the legislatures

[^447]of the northern parts of the United States, will extend by degrees southward and towards those western regions, where, by the effect of an imprudent and fatal law, slavery and its iniquities have passed the chain of the Alleghanies and the banks of the Mississippi : let us hope that the force of public opinion, the progress of knowledge, the softening of manners, the legislation of the new continental republics, and the great and happy event of the recognition of Hayti by the French government, will, either from motives of prudence and fear, or from more noble and disinterested sentiments, exercise a happy influence on the amelioration of the state of the blacks in the rest of the West Indies, in the Carolinas, Guiana, and Brazil.

In order to slacken gradually the bonds of slavery, the laws against the slave-trade must be most strictly enforced, and punishments inflicted for their infringement; mixed tribunals must be formed, and the right of search exercised with equitable reciprocity. It is melancholy to learn, that owing to the culpable indifference of some of the governments of Europe, the slave-trade (more cruel from having become more secret) has dragged from Africa, within ten years, almost the same number of negroes as before 1807; but we must not from this fact infer the inutility, or, as the secret partisans of slavery assert, the practical impossibility of the beneficent measures adopted first by Denmark, the United States, and Great Britain, and successively by all the rest of Europe. What passed from 1807 till the time when France recovered possession of her ancient colonies, and what passes in our days in nations whose governments sincerely desire the abolition of the slave-trade and its abominable practices, proves the fallacy of this conclusion. Besides, is it reasonable to compare numerically the importation of slaves in 1825 and in 1806? With the activity prevailing in every enterprise of industry, what an increase would the importation of negroes have taken in the English West Indies, and the southern provinces of the United States, if the slave-trade, entirely free, had continued to supply new slaves, and had rendered the care of their preservation, and the increase of the old population, superfluous? Can we believe that the English trade would have been limited, as in 1806, to the sale of 53,000 slaves; and
that of the United States, to the sale of 15,000 ? It is pretty well ascertained that the English islands received in the 106 years preceding 1786, more than $2,130,000$ negroes, forcibly carried from the coast of Africa. At the period of the French revolution, the slave-trade furnished (according to Mr. Norris) 74,000 slaves annually, of which the English colonies absorbed 38,000 , and the French 20,000 . It would be easy to prove that the whole of the West Indian archipelago, which now comprises scarcely $2,400,000$ negroes and mulattoes (free and slaves), received, from 1670 to 1825, nearly $5,000,000$ of Africans. These revolting calculations respecting the consumption of the human species, do not include the number of unfortunate slaves who have perished in the passage, or have been thrown into the sea as damaged merchandize.* By how many thousands must we have augmented the loss, if the two nations most distinguished for ardour and intelligence in the development of commerce and industry, the English and the inhabitants of the United States, had continued, from 1807, to carry on the trade as freely as some other nations of Europe? Sad experience has proved how much the treaties of the 15th July, 1814, and of the 22nd January, 1815, by which Spain and Portugal reserved to themselves $\dagger$ "the trade in blacks" during a certain number of years, have been fatal to humanity.

The local authorities, or rather the rich proprietors, forming the Ayuntamiento of the Havannah, the Consulado, and the Patriotic Society, have on several occasions shown a disposition favourable to the amelioration of the condition of the slaves. $\dagger$ If the government of the mother-country, instead of dreading the least appearance of innovation, had

[^448]taken advantage of those propitious circumstances, and of the ascendency of some men of abilities over their countrymen, the state of society would have undergone progressive changes; and in our days, the inhabitants of the island of Cuba would have enjoyed some of the improvements which have been under discussion for the space of thirty years. The movement at Saint Domingo, in 1790, and those which took place in Jamaica, in 1794, caused so great an alarm among the haciendados of the island of Cuba, that in a Junta economica it was warmly debated what measure could be adopted to secure the tranquillity of the country. Regulations were made respecting the pursuit of fugitive slaves,* which, till then, had given rise to the most revolting excesses; it was proposed to augment the number of negresses on the sugar estates, to direct more attention to the education of children, to diminish the introduction of African negroes, to bring white planters from the Canaries, and Indian planters from Mexico, to establish country schools with the view of improving the manners of the lower class, and to mitigate slavery in an indirect way. These propositions had not the desired effect. The junta opposed every system of immigration, and the majority of the proprietors, indulging their old illusions of security, would not restrain the slave-trade,

[^449]when the ligh price of the produce gave a hope of extraordinary profit. It would, however, be unjust not to acknowledge in this struggle between private interests and the views of wise policy, the desires and the principles manifested by some inhabitants of the island of Cuba, either in their own name or in the name of some rich and powerful corporations. "The humanity of our legislation," says M. d'Arango nobly,* in a memoir written in 1796, "grants the slave four rights (quatro consuelos), which somewhat assuage his sufferings, and which have always been refused him by a foreign policy. These rights are, the choice of a master less severe; $\dagger$ the privilege of marrying according to his own inclination ; the possibility of purchasing his liberty $\ddagger$ by his labour, and of paying, with an acquired property, for the liberty of his wife and children.§ Notwithstanding the wisdom and mildness of Spanish legislation, to how many

[^450]excesses the slave is exposed in the solitude of a plantation or a farm, where a rude capataz, armed with a cutlass (machete) and a whip, exercises absolute authority with impunity! The law neither limits the punishment of the slave, nor the duration of labour; nor does it prescribe the quality and quantity of his food.* It permits the slave, it is true, to have recourse to a magistrate, in order that he may enjoin the master to be more equitable; but this recourse is nearly illusory; for there exists another law, according to which every slave may be arrested and sent back to his master who is found without permission at the distance of a league and a half from the plantation to which he belongs. How can a slave, whipped, exhausted by hunger, and excess of labour, find means to appear before the magistrate? and if he did reach him, how would he be defended against a powerful master, who calls the hired accomplices of his cruelties, as witnesses."

In conclusion I may quote a very remarkable extract from the Representacion del Ayuntamiento, Consulado, y Sociedad patriotica, dated July 20th, 1811. "In all that relates to the changes to be introduced in the captive class, there is much less question of our fears on the diminution of agricultural wealth, than of the security of the whites, so easy to be compromised by imprudent measures. Besides, those who accuse the consulate and the municipality of the Havannah of obstinate resistance, forget that, in the year 1799, the same authorities proposed fruitlessly, that the government would divert attention to the state of the blacks in the the island of Cuba (del arreglo de este delicado asunto.) Further, we are far from adopting the maxims which the

[^451]nations of Europe, who boast of their civilization, have regarded as incontrovertible; that, for instance, without slaves there could be no colonies. We declare, on the contrary, that without slaves, and even without blacks, colonies might have existed, and that the whole difference would have been comprised in more or less profit, by the more or less rapid increase of the products. But such being our firm persuasion, we ought also to remind your Majesty, that a social organization into which slavery has been introduced as an element, cannot be changed with inconsiderate precipitation. We are far from denying that it was an evil contrary to all moral principles, to drag slaves from one continent to another; that it was a political error not to have listened to the remonstrances of Ovando, the governor of Hispaniola, who complained of the introduction and accumulation of so many slaves in proximity with a small number of free men; but, these evils being now inveterate, we ought to avoid rendering our position and that of our slaves worse, by the employment of violent means. What we ask of your Majesty, is conformable to the wish proclaimed by one of the most ardent protectors of the rights of humanity, by the most determined enemy of slavery; we desire, like him, that the civil laws should deliver us at the same time from abuses and dangers."

On the solution of this problem depends, in the West India Islands only, and exclusive of the republic of Hayti, the security of 875,000 free men (whites and men of colour)* and the mitigation of the sufferings of $1,150,000$ slaves. It is evident that these objects can never be attained by peaceful means, without the concurrence of the local authorities, either colonial assemblies, or meetings of proprietors designated by less dreaded names, by the old parent state. The direct influence of the authorities is indispensible; and it is a fatal error to believe " that we may leave it to time to act." Time will act simultaneously on the slaves, on the relations between the islands and the inhabitants of the continent, and on events which cannot be controlled, when they have been waited for with the inaction of apathy. Wherever slavery is

[^452]long established, the increase of civilization solely has less influence on the treatment of slaves than many are disposed to admit. The civilization of a nation seldom extends to a great number of individuals ; and does not reach those, who in the plantations are in immediate contact with the blacks. I have known very humane proprietors shrink from the diffculties that arise in the great plantations; they hesitate to disturb established order, to make innovations, which, if not simultaneous, not supported by the legislation, or (which would be more powerful) by public feeling, would fail in their end, and perhaps aggravate the wretchedness of those whose sufferings they were meant to alleviate. These considerations retard the good that might be effected by men animated by the most benevolent intentions, and who deplore the barbarous institutions which have devolved to them by inheritance. They well know, that to produce an essential change in the state of the slaves, to lead them progressively to the enjoyment of liberty, requires a firm will on the part of the local authorities, the concurrence of wealthy and enlightened citizens, and a general plan in which all chances of disorder, and means of repression, are wisely calculated. Without this community of action and effort, slavery, with its miseries and excesses, will survive as it did in ancient Rome,* along with elegance of manners, progressive intelligence, and all the charms of the civilization which its presence accuses, and which it threatens to destroy, whenever the hour of vengeance shall arrive. Civilization, or slow national demoralization, merely prepare the way for future events; but to produce great changes in the social state, there must be a coincidence of certain events, the period of the occurrence of which cannot be calculated. Such is the complication of human destiny, that the same cruelties which tarnished the conquest of America, have been re-enacted before our own eyes in times which we suppose to be characterized by vast progress, infor-
*The argument deduced from the civilization of Rome and Greece, in favour of slavery, is much in vogue in the West Indies, where sometimes we find it adorned with all the graces of erudition. Thus, in speeches delivered in 1795, in the Legislative Assembly of Jamaica, it was alleged, that from the example of elephants having been employed in the wars of Pyrrhus and Hannibal, it could not be blameable to have brought a hundred dogs and forty hunters from the island of Cuba to hunt the maroon negroes. Bryan Edwards, vol. i, p. 570.
mation, ana general refinement of manners. Within the interval embraced by the span of one life, we have seen the reign of terror in France, the expedition to St. Domingo,* the political re-action in Naples and Spain, I may also add, the massacres of Chio, Ipsara, and Missolonghi, the work of the barbarians of Eastern Europe, which the civilized nations of the north and west did not deem it their duty to prevent. In slave countries, where the effect of long habit tends to legitimize institutions the most adverse to justice, it is vain to count on the influence of information, of intellectual culture, or refinement of manners, except in as much as all those benefits accelerate the impulse given by governments, and facilitate the execution of measures once adopted. Without the directive action of governments and legislatures, a peaceful revolution is a thing not to be hoped for. The danger becomes the more imminent when a general inquietude pervades the public mind; when amidst the political dissensions of neighbouring countries, the faults and the duties of governments have been revealed: in such cases tranquillity can be restored only by a ruling authority, which in the noble consciousness of its power and right, sways events by entering itself on the career of improvement.
*The North American Review for 1821, No. 30, contains the following passage:-" Conflicts with slaves fighting for their freedom, are not only dreadful on account of the atrocities to which they give rise on both sides; but even after freedom has been gained, they help to confound every sentiment of justice and injustice. Some planters are condemning to death all the male negro population above six years of age. They affirm that those who have not borne arms will be contaminated by the example of those who have been fighting. This merciless act is the consequence of the result of the continued misfortunes of the colonies. "-Charault, Reflexions sur Saint Domingue.

## Chapter XXXII.

## GEOGNOSTIC DESCRIPTION OF SOUTH AMERICA.

North of the River Amazon, and East of the Meridian of the Sierra Nevada de Merida.

The object of this memoir is to concentrate the geological observations which I collected during my journeys among the mountains of New Andalusia, and Venezuela, on the banks of the Orinoco, and in the Llanos of Barcelona, Calabozo, and the Apure; consequently, from the coast of the Caribbean Sea, to the valley of the Amazon, between $2^{\circ}$ and $10 \frac{1}{2}^{\circ}$ north latitude.

The extent of country which I traversed in different directions, was more than 15,400 square leagues. It has already formed the subject of a geological sketch, traced hastily on the spot, after my return from the Orinoco, and published in 1801. At that period, the direction of the Cordillera on the coast of Venezuela, and the existence of the Cordillera of Parime, were unknown in Europe. No measure of altitude had been attempted beyond the province of Quito; no rock of South America had been named; there existed no description of the superposition of rocks in any region of the tropics. Under these circumstances, an essay tending to prove the identity of the formations of the two hemispheres, could not fail to excite interest. The study of the collections which I brought back with me, and four years of journeying in the Andes, have enabled me to rectify my first views, and to extend an investigation which, by reason of its novelty, had been favourably received. That the most remarkable geological relations may be the more easily seized, I shall treat aphoristically, in different sections, the configuration of the soil, the general division of the land, the direction and inclination of the beds, and the nature of the primitive, intermediary, secondary, and tertiary rocks.


#### Abstract

Section I. Configuration of the Country-Inequalities of the Soil-Chains and Groups of Mountains-Divisionary Ridges-Plains or Llanos.


Souti America is one of those great triangular masses which form the three continental parts of the southern hemisphere of the globe. In its exterior configuration it resembles Africa more than Australia. The southern extremities of the three continents are so placed, that in sailing from the Cape of Good Hope (lat. $33^{\circ} 55^{\prime}$ ) to Cape Horn (lat. $55^{\circ} 58^{\prime}$ ), and doubling the southern point of Van Diemen's Land (lat. $43^{\circ} 38^{\prime}$ ), we see those lands stretching out towards the south pole in proportion as we advance eastward. A fourth part of the 571,000 square sea leagues* which South America comprises, is covered with mountains distributed in chains, or gathered together in groups. The other parts are plains forming long uninterrupted bands covered with forests or gramina, flatter than in Europe, and rising progressively, at the distance of 300 leagues from the coast, between 30 and 170 toises above the level of the sea. The inost considerable mountainous chain in South America extends from south to north, according to the greatest dimension of the continent; it is not central like the European chains, nor far removed from the sea-shore, like the Himalaya and the Hindoo-Koosh; but it is thrown towards the western extremity of the continent, almost on the coast of the Pacific Ocean. Referring to the profile which I have given $\dagger$ of the configuration of South America, in the latitude of Chimborazo and Grand Para, across the plains of the Amazon, we find the land low towards the east, in an inclined plane, at an angle of less than 25 seconds on a length of 600 leagues; and if, in the ancient state of our planet, the Atlantic Ocean, by some extraordinary cause, ever rose to 1100 feet above its present level (a height one-third less than the table-lands of Spain and Bavaria), the waves must, in the province of Jaen de Bracamoros, have broken upon the rocks that bound the eastern

[^453]declivity of the Cordilleras of the Andes. The rising of this ridge is so inconsiderable compared to the whole continent, that its breadth in the parallel of Cape Saint Roche is 1400 times greater than the average beight of the Andes.

We distinguish in the mountainous part of South America, a chain and three groups of mountains, namely, the Cordillera of the Andes, which the geologist may trace without interruption, from Cape Pilares, in the western part of the Straits of Magellan, to the promontory of Paria, opposite the island of Trinidad; the insulated group of the Sierra Nevada de Santa Marta; the group of the mountains of the Orinoco, or of La Parime; and that of the mountains of Brazil. The Sierra de Santa Marta being nearly in the meridian of the Cordilleras of Peru and New Grenada, the snowy summits descried by navigators in passing the mouth of the Rio Magdalena, are commonly mistaken for the northern extremity of the Andes. I shall soon prove that the colossal group of the Sierra de Santa Marta is almost entirely separate from the mountains of Ocaña and Pamplona, which belong to the eastern Cordillera of New Grenada. The hot plains through which runs the Rio Cesar, and which extend towards the valley of Upar, separate the Sierra Nevada from the Paramo de Cacota, south of Pamplona. . The ridge which divides the waters between the gulf of Maracaibo and the Rio Magdalena, is in the plain on the east of the Laguna Zapatoza. If, on the one hand, the Sierra de Santa Marta has been erroneously considered (on account of its eternal snow, and its longitude) to be a continuation of the Cordillera of the Andes, on the other hand, the connexion of that same Cordillera with the coast mountains of the provinces of Cumana and Caracas, has not been recognized. The littoral chain of Venezuela, of which the different ranges form the Montaña de Paria, the isthmus of Araya, the Silla of Caracas, and the gneissgranite mountains north and south of the lake of Valencia, is joined between Porto Cabello, San Felipe, and Tocuyo, to the Paramos de las Rosas and Niquitao, which form the north-east extremity of the Sierra de Merida, and the eastern Cordillera of the Andes of New Grenada. It is sufficient here to mention this connexion, so important in a geological point of view; for the denominations of Andes and Cor-
dilleras being altogether in disuse as applied to the chains of mountains extending from the eastern gulf of Maracaibo to the promontory of Paria, we shall continue to designate those chains (stretching from west to east) by the names of "littoral chain," or " coast-chain of Venezuela."

Of the three insulated groups of mountains, that is to say, those which are not branches of the Cordillera of the Andes and its continuation towards the shore of Venezuela, one is on the north, and the other two on the west of the Andes : that on the north is the Sierra Nevada de Santa Marta; the two others are the Sierra de la Parime, between $4^{\circ}$ and $8^{\circ}$ of north latitude, and the mountains of Brazil, between $15^{\circ}$ and $28^{\circ}$ south latitude. This singular distribution of great inequalities of soil produces three plains or basins, comprising a surface of 420,600 square leagues, or four-fifths of all South America, east of the Andes. Between the coast-chain of Venezuela and the group of the Parime, the plains of the Apure and the Lower Orinoco extend; between the group of Parime and the Brazil mountains are the plains of the Amazon, of the Rio Negro, and the Madeira, and between the groups of Brazil and the southern extremity of the continent are the plains of Rio de la Plata, and of Patagonia. As the group of the Parime in Spanish Guiana, and of the Brazil mountains (or of Minas Geraes and Goyaz), do not join the Cordillera of the Andes of New Grenada and Upper Peru towards the west, the three plains of the Lower Orinoco, the Amazon, and the Rio de la Plata, are connected by land-straits of considerable breadth. These straits are also plains stretching from north to south, and traversed by ridges imperceptible to the eye, but forming "divortia aquarum." These ridges (and this remarkable phenomenon has hitherto escaped the attention of geologists) are situated between $2^{\circ}$ and $3^{\circ}$ north latitude, and $16^{\circ}$ and $18^{\circ}$ south latitude. The first ridge forms the partition of the - waters which fall into the Lower Orinoco on the north-east, and into the Rio Negro and the Amazon on the south and south-east; the second ridge divides the tributary streams of the right bank of the Amazon and the Rio de la Plata. These ridges, of which the existence is only manifested, as in Volhynia, by the course of the waters, are parallel with the coast-chain of Venezuela; they present; as it were, two
eystems of counter-slopes partially developed, in the direction from west to east, between the Guaviare and the Caqueta, and between the Mamori and the Pilcomayo. It is also worthy of remark, that in the southern hemisphere, the Cordillera of the Andes sends an immense counterpoise eastward in the promontory of the Sierra Nerada de Cochabamba, whence begins the ridge stretching between the tributary streams of the Madeira and the Paraguay to the lofty group of the mountains of Brazil or Minas Geraes. Three transversal chains (the coast-mountains of Venezuela, of the Orinoco or Parime, and the Brazil mountains) tend to join the longitudinal chain (the Andes), either by an intermediary group (between the lake of Valencia and Tocuyo), or by ridges formed by the intersection of counter-slopes in the plains. The two extremities of the three Llanos which communicate by land-straits, the Llanos of the Lower Orinoco, the Amazon, and the Rio de la Plata or of Buenos Ayres, are steppes covered with gramina, while the intermediary Llano (that of the Amazon) is a thick forest. With respect to the two land-straits, forming bands directed from north to south (from the Apure to Caqueta across the Provincia de los Llanos, and the sources of the Mamori to Rio Pilcomayo, across the province of Mocos and Chiquitos) they are bare and grassy steppes like the plains of Caracas and Buenos Ayres.

In the immense extent of land east of the Andes, comprehending more than 480,000 square sea leagues, of which $\mathbf{9 2 , 0 0 0}$ are a mountainous tract of country, no group rises to the region of perpetual snow; none even attains the height of 1,400 toises. This lowering of the mountains in the eastern region of the New Continent, extends as far as $60^{\circ}$ north latitude; while in the western part, on the prolongation of the Cordillera of the Andes, the highest summits rise in Mexico (lat. $18^{\circ} 59^{\prime}$ ), to 2770 toises, and in the Rocky Mountains (lat. $37^{\circ}$ to $40^{\circ}$ ) to 1900 toises. The insulated group. of the Alleghanies, corresponding in its eastern position and direction with the Brazil group, does not exceed 1040 toises.* The lofty summits, therefore,

* The culminant point of the Alleghanies is Mount Washington, in New Hampshire, lat. $444^{\circ}$. According to Captain Partridges its height is 6634 English feet.

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thrice exceeding the height of Mont Blanc, belong only to the longitudinal chain which bounds the basin of the Pacific Ocean, from $55^{\circ}$ south to $68^{\circ}$ north latitude, that is to say, the Cordillera of the Andes. The only insulated group that can be compared with the snowy summits of theequinoctial Andes, and which attains the height' of nearly 3000 toises, is the Sierra de Santa Marta; it is not situated on the east of the Cordilleras, but between the prolongation of two of their branches, those of Merida and Veragua. The Cordilleras, where they bound the Caribbean Sea, in that part which we designate by the name of Coast Chain of Venezuela, do not attain the extraordinary height ( 2500 toises) which they reach in their prolongation towards Chits; and Merida. Considering separately the groups of the east, those of the shore of Venezuela, of the Parime, and Brazil, we see their height diminish from north to south. The highest summits of each group are the Silla de Caracas ( 1350 toises), the peak of Duida ( 1300 toises), the Itacolumi and the Itambe * ( 900 toises). But, as I have elsewhere observed, it would be erroneous to judge the height of a chain of mountains solely from that of the most lofty summits. The peak of the Himalayas; accurately measured, is 676 toises higher than Chimborazo; Chimborazo is 900 toises higher than Mont Blanc; and Mont Blanc 658 toises higher than the peak of Nethou. $\ddagger$ These differences do not fornish the relative average heights of the Himalayas, the Andes, the Alps and the Pyrenees, that is, the height of the back of the mountains, on which arise the peaks, needles, pyramids, or rounded domes. It is that part of the back where passes are made, which furnishes a precise measure of the minimum of the height of the great chains. In comparing the whole of my measures with those of Moorcroft, Webb, Hodgson, Saussure, and Ramond, I estimate the average height of the top of the Himalayas, between the

[^454]meridians of $75^{\circ}$ and $77^{\circ}$, at 2450 toises; the Andes* (at Peru, Quito, and New Grenada), at 1850 toises; the summit of the Alps and Pyrenees at 1150 toises. The difference of the mean height of the Cordilleras (between $5^{\circ}$ north and $2^{\circ}$ south lat.) and the Swiss Alps, is consequently 200 toises less than the difference of their loftiest summits; and in comparing the passes of the Alps, we see that their average height is nearly the same, although peak Nethou is 600 toises lower than Mont Blanc and Mont Rosa. Between the Himalayat and the Andes, on the contrary, (considering those chains in the limits which I have just indicated), the difference between the mean height of the ridges and that of the loftiest summits presents nearly the same proportions.

Taking an analogous view of the groups of mountains at the east of the Andes, we find the average height of the coast-chain of Venezuela to be 750 toises; of the Sierra Parime, 500 toises; of the Brazilian group, 400 toises; whence it follows that the mountains of the eastern region of South America, between the tropics, are, when compared to the medium elevation of the Andes, in the relation of one to three.

The following is the result of some numerical statements, the comparison of which affords more precise ideas on the structure of mountains in general. $\ddagger$

[^455]| wames of the chatis of moumtans. | The higheat summils. | Mean helght of the ridge. | Proportion of helicht of th ridges to that ot the higbest summits. summitis. |
| :---: | :---: | :---: | :---: |
| Himalayas (between N. lat. $30^{\circ} 18^{\prime}$ and $31^{\circ} 53^{\prime}$, and long. $75^{\circ} 23^{\circ}$ and $77^{\circ} 38^{\prime}$ ) $\qquad$ | 4026 t. | 2450 t. | $1: 1 \cdot 6$ |
| Cordillera of the Andes (between lat. $5^{\circ}$ and $2^{\circ}$ S. $\qquad$ | 3350 t. | 1850 t. | 1 : 188 |
| Alps of Switzerland ...................... | 2450 t. | 1150 t. | $1: 2 \cdot 1$ |
| Pyrenees ....................................... | 1787 t. | 1150 t. | 1 : $1 \cdot 5$ |
| Littoral Chain of Venezucla | 1350 t. | 750 t. | $1: 1.8$ |
| Group of the Mountains of the Parime $\qquad$ | 1300 t. | 500 t. | $1: 2.6$ |
| Group of the Mountains of Brazil .. | 900 t . | 500 t. | $1: 2 \cdot 3$ |

If we distinguish among the mountains those which rise sporadically, and form small insulated systems,* and those that mike part of a continued chain, $\dagger$ we find that, notwithstanding the immense height $\ddagger$ of the summits of some insulated systems, the culminant points of the whole globe belong to continuous chains,-to the Cordilleras of Central Asia, and South America.

In that part of the Andes with which I am best acquainted, between $8^{\circ}$ south lat., and $21^{\circ}$ north lat., all the

* As the groups of the Canaries, the Azores, the Sandwich Islands, the Monts-Dorés, and the Euganean mountains.
$\dagger$ The Himalayas, the Alps, and the Andes.
$\ddagger$ Among the insulated systems, or sporadic mountains, Mowna. Roa is generally regarded as the most elevated summit of the Sandwich Islands. Its height is computed at 2500 toises, and yet at some seasons it is entirely free from snow. An exact measure of this summit, situated in very frequented latitudes, has for 25 years, been desired in vain by naturalists and geologists.
colossal summits are of trachyte. It may almost be admitted as a general rule, that whenever the mass of mountains rises in that region of the tropics much above the limit of perpetual snow ( $2300-2470$ toises), the rocks commonly called primitive (for instance, gneiss-granite or mica-slate) disappear, and the summits are of trachyte or trappeanporphyry. I know only a few rare exceptions to this law, and they occur in the Cordilleras of Quito, where the Nevados of Conderasto and Cuvillan, situated opposite to the trachytic Chimborazo, are composed of mica-slate, and contain veins of sulphuret of silver. Thus in the groups of detached mountains which rise abruptly from the plains, the loftiest summits, such as Mowna-Roa, the Peak of Teneriffe, Etna, and the Peak of the Azores, present only recent volcanic rocks. It would, however, be an error to extend that law to every other continent, and to admit, as a general rule, that, in every zone, the greatest elevations have produced trachytic domes: gneiss-granite and mica-slate constitute the summits of the ridge, in the almost insulated group of the Sierra Nevada of Grenada and the Peak of Malhacen,* as they also do in the continuous chain of the Alps, the Pyrenees, and probably the Himalayas $\dagger$. These phenomena, discordant in appearance, are possibly all effects of the same cause : granite, gneiss, and all the so-styled primitive Neptunian mountains, may possibly owe their origin to volcanic forces, as well as the trachytes; but to forces of which the action resembles less the still-burning volcanoes of our days, ejecting lava, which at the moment of its eruption comes immediately into contact with the atmospheric air; but it is not here my purpose to discuss this great theoretic question.

After having examined the general structure of South America according to considerations of comparative geology,

[^456]I shall proceed to notice separately the different systems of mountains and plains, the mutual connection of which has so powerful an influence on the state of industry and commerce in the nations of the New Continent. I shall give only a general view of the systems situated beyond the limits of the region which forms the special object of this memoir. Geology being essentially founded on the study of the relations of juxtaposition and place, I could not treat of the littoral chain and the chain of the Parime separately, without touching on the other systems south and west of Venezuela.

## A. Systems of MFountains.

I. Cordilleras of the Andes. This is the most continuous, the longest, the most uniform in its direction from south to north and north-north-west, of any chain of the globe. It approaches the north and south poles at unequal distances of from $22^{\circ}$ to $33^{\circ}$. Its development is from 2800 to 3000 leagues, ( 20 to a degree,) a length equal to the distance from Cape Finisterre in Galicia to the north-east cape (Tschuktschoi-Noss) of Asia. Somewhat less than one half of this chain belongs to South America, and runs along its western shores. North of the isthmus of Cupica and of Panama, after an immense lowering, it assumes the appearance of a nearly central ridge, forming a rocky dyke that joins the great continent of North America to the southern continent. The low lands on the east of the Andes of Guatimala and New Spain, appear to have been overwhelmed by the ocean, and now form the bottom of the Caribbean Sea. As the continent beyond the parallel of Florida again widens towards the east, the Cordilleras of Durango and New Mexico, as well as the Rocky Mountains, merely a continuation of those Cordilleras, appear to be thrown still further westward, that is, towards the coast of the Pacific Ocean ; but they still remain eight or ten times more remote from it than in the southern hemisphere. We may consider as the two extremities of the Andes, the rock or granitic island of Diego Ramirez, south of Cape Horn, and the mountains lying at the mouth of Mackenzie River, (lat $69^{\circ}$, long. $130 \frac{1}{2}^{\circ}$ ), more than twelve degrees west of the greenstone
mountains, known by the name of the Copper Mountains, visited by Captain Franklin. The colossal peak of Saint Elias and that of Mount Fairweather, in New Norfolk, do not, properly speaking, belong to the northern prolongation of the Cordilleras of the Andes, but to a parallel chain (the maritime Alps of the north-west coast), stretching towards the peninsula of California, and connected by transversal ridges with a mountainous land, between $45^{\circ}$ and $53^{\circ}$ of latitude, with the Andes of New Mexico (Rocky Mountains). In South America the mean breadth of the Cordillera of the Andes is from 18 to 22 leagues.* It is only in the knots of the mountains, that is where the Cordillera is swelled by side-groups or divided into several chains nearly parallel, and re-uniting at intervals, for instance, on the south of the lake of Titicaca, that it is more than 100 to 120 leagues broad, in a direction perpendicular to its axis. The Andes of South America bound the plains of the Orinoco, the Amazon, and the Rio de la Plata, on the west, like a rocky wall raised across a crevice 1300 leagues long, and stretching from south to north. This upheaved part (if I may be permitted to use an expression founded on a geological hypothesis), comprises a surface of 58,900 square leagues, between the parallel of Cape Pilesar, and the northern Choco. To form an idea of the variety of rocks which this space may furnish for the observation of the traveller, we must recollect that the Pyrenees, according to the observations of M. Charpentier, occupy only 768 square sea leagues.
The name of Andes in the Quichua language (which wants the consonants $d, f$, and $g$ ) Antis, or Ante, appears to me to be derived from the Peruvian word anta, signifying copper or metal in general. Anta chacra signifies mine of copper; antacuri, copper mixed with gold; and puca anta, copper, or red metal. As the group of the Altai mountains t takes

[^457]its name from the Turkish word altor or altyn, in the same manner the Cordilleras may have been termed "Coppercountry," or Anti-suyu, on account of the abundance of that metal, which the Peruvians employed for their tools. The Inca Garcilasso, who was the son of a Peruvian princess, and who wrote the history of his native country in the first years of the conquest, gives no etymology of the name of the Andes. He only opposes Anti-suyu, or the region of summits covered with eternal snow (ritiseca), to the plains or Funcas, that is, to the lower region of Peru. The etymology of the name of the largest mountain chain of the globe cannot be devoid of interest to the mineralogic geographer.

The structure of the Cordillera of the Andes, that is, its division into several chains nearly parallel, which are again joined by knots of mountains, is very remarkable. On our maps this structure is indicated but imperfectly; and what La Condamine and Bouguer merely guessed, during their long visit to the table-land of Quito, has been generalized and ill-interpreted by those who have described the whole chain according to the type of the equatorial Andes. The following is the most accurate information I could collect by my own researches, and an active correspondence of twenty years with the inhabitants of Spanish America. The group of islands called Tierra del Fuego, in which the chain of the Andes begins, is a plain extending from Cape Espiritu Santo as far as the canal of San Sebastian. The country on the west of this canal, between Cape San Valentino and Cape Pilares, is bristled with granitic mountains covered (from the Morro de San Agueda to Cabo Redondo) with calcareous shells. Navigators have greatly exaggerated the height of the mountains of Tierra del Fuego, among which there appears to be a volcano still burning. M. de Churruca found the height of the western peak of Cape Pilares (lat. $52^{\circ} 45^{\prime}$ south) only 218 toises; even Cape Horn is probably not more than 500 toises* high. The plain extends on the northern shore of the Straits of Magellan, from the Virgin's Cape to Cabo Negro;

* It is very distinctly seen at the distance of 60 miles, which, without calculating the effects of terrestial refraction, would give it a height of 498 toises.
at the latter the Cordilleras rise abruptly, and fill the whole space as far as Cape Victoria (lat. $52^{\circ} 22^{\prime}$ ). The region between Cape Horn and the southern extremity of the continent somewhat resembles the origin of the Pyrenees between Cape Creux (near the gulf of Rosas) and the Col des Perdus. The height of the Patagonian chain is not known; it appears, however, that no summit south of the parallel of $48^{\circ}$ attains the elevation of the Canigou ( 1430 toises), which is near the eastern extremity of the Pyrenees. In that southern country, where the summers are so cold and short, the limit of eternal snow must lower at least as much as in the northern hemisphere, in Norway, in lat. $63^{\circ}$ and $64^{\circ}$; consequently below 800 toises. The great breadth, therefore, of the band of snow that envelopes these Patagonian summits, does not justify the idea which travellers form of their height in $40^{\circ}$ south latitude. As we advance towards the island of Chiloe, the Cordilleras draw near the coast; and the archipelago of Chonos or Huaytecas appears like the vestiges of an immense group of mountains overwhelmed by water. Narrow estuaries fill the lower vallies of the Andes, and remind us of the fjords of Norway and Greenland. We there find, running from south to north, the Nevados de Maca (lat. $45^{\circ} 19^{\prime}$ ), of Cuptano (lat. $44^{\circ} 58^{\prime}$ ), of Yanteles (lat. $43^{\circ} 52^{\prime}$ ), of Corcovado, Chayapirca (lat. $42^{\circ} 52^{\prime}$ ) and of Llebean (lat. $41^{\circ}$ 49'). The peak of Cuptana rises like the peak of Teneriffe, from the bosom of the sea; but being scarcely visible at thirty-six or forty leagues distance, it cannot be more than 1500 toises high. Corcovado, situated on the coast of the continent, opposite the southern point of the island of Chiloe, appears to be more than 1950 toises high; it is perhaps the loftiest summit of the whole globe, south of the parallel of $42^{\circ}$ south latitude. On the north of San Carlos de Chiloe, in the whole length of Chile to the desert of Atacama, the low western regions not having been overwhelmed by floods, the Andes there appear farther from the coast. The Abbé Molina affirms that the Cordilleras of Chile form three parallel chains, of which the intermediary is the most elevated; but to prove that this division is far from general, it suffices to recollect the barometric survey made by MM. Bauza and Espinosa, in 1794, between Men-
doza and Santiago de Chile. The road leading from one of those towns to the other, rises gradually from 700 to 1987 toises; and after passing the Col des Andes (La Cumbre, between the houses of refuge called Las Calaveras and Las Cuevas), it descends continually as far as the temperate valley of Santiago de Chile, of which the bottom is only 409 toises above the level of the sea. The same survey has made known the minimum of height at Chile of the lower limit of snow, in $33^{\circ}$ south latitude. The limit does not lower in summer to 2000 toises.* I think we may conclude according to the analogy of the Snowy Mountains of Mexico and southern Europe, and considering the difference of the summer temperature of the two hemispheres, that the real Nevadas at Chile, in the parallel of Valdivia (lat. $40^{\circ}$ ), cannot be below 1300 toises; in Valparaiso (lat. $33^{\circ}$ ) not lower than 2000 toises, and in that of Copiapo (lat. $27^{\circ}$ ) not below 2200 toises of height. These are the limit-numbers, the minimum of elevation, which the ridge of the Andes of Chile must attain in different degrees of latitude, to enable their summits to rise above the line of perpetual snow. The numerical results which I have just marked, and which are founded on the laws of distribution of heat, have still the same importance which they possessed at the time of my travels in America; for there does not exist in the immense extent of the Andes, from $8^{\circ}$ south latitude to the Straits of Magellan, one Nevada of which the height above the sea-level has been determined, either by a simple geometric measure, or by the combined means of barometric and geodesic measurements.

Between $33^{\circ}$ and $18^{\circ}$ south latitude, between the parallels of Valparaiso and Arica, the Andes present towards the east three remarkable spurs, the Sierra de Cordova, the Sierra de Salta, and the Nevados de Cochabamba. Travellers partly cross, and partly go along the side of the Sierra de Cordova (between $33^{\circ}$ and $31^{\circ}$ of latitude), in their way from Buenos Ayres to Mendoza; it may be said to be the most southern promontory which advances, in the Pampas, towards the meridian of $65^{\circ}$; it gives birth to the great river known by the name of Desaguadero de Mendoza, and extends

* On the sonthern declivity of the Himalayas snow begins ( $3^{\circ}$. nearer the
guator) at 1970 toises. equator) at 1970 toises.
from San Juan de la. Frontera and San Juan de la Punta to the town of Cordova. The second spur, called the Sierra de Salta and the Jujui, of which the greatest breadth is $25^{\circ}$ of latitude, widens from the valley of Catamarca and San Miguel del Tucuman, in the direction of the Rio Vermejo (longitude $64^{\circ}$ ). Finally, the third, and most majestic spur, the Sierra Nevada de Cochabamba and Santa Cruz (from $22^{\circ}$ to $17 \frac{1}{2}^{\circ}$ of latitude), is linked with the knot of the mountains of Porco. It forms the points of partition (divortia aquarum, between the basin of the Amazon and that of the Rio de la Plata. The Cachimayo and the Pilcomayo, which rise between Potosi, Talavera de la Puna, and La Plata or Chuquisaca, run in the direction of south-east, while the Parapiti and the Guapey (Guapaiz, or Rio de Mizque), pour their waters into the Mamori, to north-east. The ridge of partition being near CLayanta, south of Mizque, Tomina, and Pomabamba, nearly on the southern declivity of the Sierra de Cochabamba in lat. $19^{\circ}$ and $20^{\circ}$, the Rio Guapey flows round the whole group, before it reaches the plains of the Amazon, as in Europe the Poprad, a tributary of the Vistula, makes a circuitin its course from the southern part of the Carpathians to the plains of Poland. I have already observed above, that where the mountains cease (west * of the meridian of $66{ }^{\frac{1^{\circ}}{}}$ ), the partition ridge of Cochabamba goes up towards the north-east, to $16^{\circ}$ of latitude, forming, by the intersection of two slightly inclined planes, only one ridge amidst the savannahs, and separating the waters of the Guaporè, a tributary of the Madeira, from those of the Aguapehy and Jauru, tributaries of the Rio Paraguay. This vast country between Santa Cruz de la Sierra, Villabella, and Matogrosso, is one of the least known parts of South America. The two spurs of Cordova and Salta present only a mountainous territory of small elevation, and linked to the foot of the Andes of Chile. Cóchabamba, on the contrary, attains the limit of perpetual snow ( 2300 toises), and forms in some sort a lateral branch of the Cordilleras, diverging even from their tops between La Paz and Oruro. The mountains composing this.

[^458]branch (the Cordillera de Chiriguanaes, de los Sauces, and Yuracarées), extend regularly from west to east; their eastern declivity* is very rapid, and their loftiest summits are not in the centre, but in the northern part of the group.

The principal Cordillera of Chile and Upper Peru is, for the first time, ramified very distinctly into two branches, in the group of Porco and Potosi, between lat. $19^{\circ}$ and $20^{\circ}$. These two branches comprehend the table-land extending from Carangas to Lamba (lat. $193^{\circ}-15^{\circ}$ ) and in which is situated the small mountain lake of Paria, the Desaguadero, and the great Laguna of Titicaca or Chucuito, of which the western part bears the name of Vinamarca. To afford an idea of the colossal dimensions of the Andes, I may here observe that the surface of the lake of Titicaca alone ( 448 square sea leagues) is twenty times greater than that of the Lake of Geneva, and twice the average extent of a department of France. On the banks of this lake, near Tiahuanacu, and in the high plains of Callao, ruins are found which bear evidence of a state of civilization anterior to that which the Peruvians assign to the reign of the Inca Manco Capac. The eastern Cordillera, that of La Paz, Palca, Ancuma, and Pelechuco, join, north-west of Apolobamba, the western Cordillera, which is the most extensive of the whole chain of the Andes, between the parallels $14^{\circ}$ and $15^{\circ}$. The imperial city of Cuzco is situated near the eastern extremity of this knot, which comprehends, in an area of 3000 square leagues, the mountains of Vilcanota, Carabaya, Abancai, Huando, Parinacochas, and Andahuaylas. Though here, as in general, in every considerable widening of the Cordillera, the grouped summits do not follow the principal axis in uniform and parallel directions, a phenomenon observable in the general disposition of the chain of the Andes, from lat. $18^{\circ}$, is well worthy the attention of geologists. The whole mass of the Cordilleras of Chile and Upper Peru, from the Straits of

[^459]Magellan to the parallel of the port of Arica ( $18^{\circ} 28^{\prime} 35^{\prime \prime}$ ), runs from south to north, in the direction of a meridian at most $5^{\circ} \mathrm{N}$. E.; but from the parallel of Arica, the coast and the two Cordilleras east and west of the Alpine lake of Titicaca, abruptly change their direction and incline to north-west. The Cordilleras of Ancuma and Moquehua, and the longitudinal valley, or rather the basin of Titicaca, which they inclose, take a direction N. $42^{\circ} \mathrm{W}$. Further on, the two branches again unite in the group of the mountains of Cuzco, and thence their direction is $\mathrm{N} .80^{\circ} \mathrm{W}$. This group of which the table-land inclines to the north-east, forms a curve, nearly from east to west, so that the part of the Andes north of Castrovireyna is thrown back more than 242,000 toises westward. This singular geological phenomenon resembles the variation of dip of the veins, and especially of the two parts of the chain of the Pyrenees, parallel to each other, and linked by an almost rectangular elbow, 16,000 toises long, near the source of the Garonne;* but in the Andes, the axes of the chain, south and north of the curve, do not preserve parallelism. On the north of Castrovireyna and Andahuaylas (lat. $14^{\circ}$ ), the direction is $\mathrm{N} .22^{\circ} \mathrm{W}$., while south of $15^{\circ}$, it is $\mathrm{N} .42^{\circ} \mathrm{W}$. The inflexions of the coast follow these changes. The shore separated from the Cordillera by a plain 15 leagues in breadth, stretches from Camapo to Arica, between $27 \frac{1}{3}^{\circ}$ and $18 \frac{1^{\circ}}{}$ lat. N. $5^{\circ}$ E.; from Arica to Pisco, between $18 \frac{1}{2}^{\circ}$ and $14^{\circ}$ lat. at first N. $42^{\circ}$ W., afterwards N. $65^{\circ}$ W.; and from Pisco to Truxillo, between $14^{\circ}$ and $8^{\circ}$ of lat. N. $27^{\circ} \mathrm{W}$. The parallelism between the coast and the Cordillera of the Andes is a phenomenon the more worthy of attention, as it occurs in several parts of the globe where the mountains do not in the same manner form the shore.

After the great knot of mountains of Cuzco and Parinacochas, in $14^{\circ}$ south latitude, the Andes present a second bifurcation, on the east and west of the Rio Jauja, which throws itself into the Mantaro, a tributary stream of the Apurimac. The eastern chain stretches on the east of Huanta, the convent of Ocopa and Tarma; the western chain, on the west of Castrovireyna, Huancavelica, Huarocheri, and Yauli. The basin, or rather the lofty table-land which is

[^460]inclosed by these chains, is nearly half the length of the basin of Chucuito or Titicaca. Two mountains covered with eternal snow, seen from the town of Lima, and which the inhabitants name Toldo de la Nieve, belong to the western chain, that of Huarocheri.

North-west of the vallies of Salcabamba, in the parallel of the ports of Huaura and Guarmey, between $11^{\circ}$ and $10^{\circ}$ latitude, the two chains unite in the knot of the Huanuco and the Pasco, celebrated for the mines of Yauricocha or Santa Rosa. There rise two peaks of colossal height, the Nevados of Sasaguanca and of La Viuda. The table-land of this knot of mountains appears in the Pambas de Bombon to be more than 1800 toises above the level of the ocean. From this point, on the north of the parallel of Huanuco, (lat. $11^{\circ}$ ) the Andes are divided into three chains :- the first, and most eastern, rises between Pozuzu and Muna, between the Rio Huallaga, and the Rio Pachitea, a tributary of the Ucayali; the second, or central, is between the Huallaga, and the Upper Marañon; the third, or western, between the Upper Marañon and the coast of Truxillo and Payta. The eastern chain is a small loteral branch which lowers into a range of hills: its direction is first N.N.E., bordering the Pampas del Sacramento, afterwards it turns W.N.W., where it is broken by the Rio Huallaga, in the Pongo, above the confluence of Chipurana, and then it loses itself in latitude $6 \frac{1}{4}^{\circ}$, on the north-west of Lamas. A transversal ridge seems to connect it with the central chain, south of Paramo de Pis-coguanuna (or Piscuaguna), west of Chachapoyas. The intermediary or central chain stretches from the knot of Pasco and Huanuco, towards N.N.W., between Xiean and Chicoplaya, Huacurachuco and the sources of the Rio Monzan, between Pataz and Pajatan, Caxamarquilla and Moyobamba. It widens greatly in the parallel of Chachapoyas, and forms a mountainous territory, traversed by deep and extremely hot vallies. On the north of the Paramo de Piscoguanuna (lat. $6^{\circ}$ ), the central chain throws two branches in the direction of La Yellaca and San Borja. We shall soon see that this latter branch forms, below the Rio Neva a tributary stream of the Amazon, the rocks that border the famous Pongo de Manseriche. In this zone, where North Peru approximates to the confines of New Grenada in lat.
$10^{\circ}$ and $5^{\circ}$, no summit of the eastern and central chains rises as high as the region of perpetual snow; the only snowy summits are in the western chain. The central chain, that of the Paramos de Callacalla, and Piscoguanuma, scarcely attains 1800 toises, and lowers gently to 800 toises; so that the mountainous and temperate tract of country which extends on the north of Chachapoyas towards Pomacocha, La Vellaca, and the source of the Rio Nieva, is rich in fine cinchona trees. After having passed the Rio Huallaga and the Pachitea, which with the Beni forms the Ucayali, we find, in advancing towards the east, only ranges of hills. The western chain of the Andes, which is the most elevated and nearest to the coast, runs almost parallel wth the shore N. $22^{\circ}$ W., between Caxatambo and Huary, Conchucos and Guamachuco, by Caxamarca, the Paramo de Yanaguanga, and Montan, towards the Rio de Guancabamba. It comprises (between $9^{\circ}$ and $7 \frac{1^{\circ}}{}{ }^{\circ}$ ) the three Nevados de Pelagatos, Moyopata, and Huaylillas. This last snowy summit, situated near Guamachuco, (in $7^{\circ} 55^{\prime}$ lat.) is the more remarkable, since from thence on the north, as far as Chimborazo, on a length of 140 leagues, there is not one mountain that enters the region of perpetual snow. This depression, or absence of; snow, extends in the same interval, over all the lateral chains; while, on the south of the Nevado de Huaylillas, it always happens that when one chain is very low, the summits of the other exceed the height of 2460 toises. It was' on the south of Micuipampa (lat. $7^{\circ} 1^{\prime}$ ) that $I$ found the magnetic equator.

The Amazon, or as it is customary to say in those regions, the Upper Marañon, flows through the western part of the longitudinal valley lying between the Cordilleras of Chachapayas and Caxamarca. Comprehending in one point of view, this valley, and that of the Rio Jauja, bounded by the Cordilleras of Tarma and Huarocheri, we are inclined to consider them as one immense basin 180 leagues long, and crossed in the first third of its length, by a dyke, or ridge 18,000 toises broad. In fact, the two alpine lakes of Lauricocha and Chinchaycocha, where the river Amazon and the Rio de Jauja take their rise, are situated south and north of this rocky dyke, which is a prolongation of the knot of Huanuco and Pasco. The Amazon, on issuing from the longitudinal valley which bounds the chains of Caxamarca
and Chachacocha, breaks the latter chain; and the point where the great river penetrates the mountains, is very remarkable. Entering the Amazon by the Rio Chamaya or Guancabamba, I found opposite the confluence, the picturesque mountain of Patachuana; but the rocks on both banks of the Amazon begin only between Tambillo and Tomependa (lat. $5^{\circ} 31^{\prime}$, long. $80^{\circ} 56^{\prime}$ ). From thence to the Pongo do Rentema, a long succession of rocks follow, of which the last is the Pongo de Tayouchouc, between the strait of Manseriche and the village of San Borja. The course of the Amazon, which is first directed north, then east, changes near Puyaya, three leagues north-east of Tomependa. Throughout the whole distance between Tambillo and San Borja, the waters force a way, more or less narrow, across the sandstones of the Cordillera of Chachapoyas. The mountains are lofty near the Embarcadero, at the confluence of the Imasa, where large trees of cinchona, which might be easily transplanted to Cayenue, or the Canaries, approach the Amazon. The rocks in the famous strait of Manseriche are scarcely 40 toises high; and further eastward, the last hills rise near Xeberos, towards the mouth of the Rio Huallaga.

I have not yet noticed the extraordinary widening of the Andes near the Apolobamba. The sources of the Rio Beni being found in the spur which stretches northward beyond the confluence of that river with the Apurimac, I shall give to the whole group the name of "the spur of Beni." The following is the most certain information I have obtained respecting those countries, from persons who had long inhabited Apolobamba, the Real das Minas of Pasco, and the convent of Ocopa. Along the whole eastern chain of Titicaca, from La Paz to the knot of Huanuco (lat. $17 \frac{1}{2}^{\circ}$ to $10 \frac{1_{2}}{}{ }^{\circ}$ ) a very wide mountainous land is situated eastward, at the back of the declivity of the Andes. It is not a widening of the eastern chain itself, but rather of the small heights that surround the foot of the Andes like a penumbra, filling the whole space between the Beni and the Pachitca. A chain of hills bounds the eastern bank of the Beni to lat. $8^{\circ}$; for the rivers Coanache and Magua, tributaries of the Ucayali (flowing in latitude $6^{\circ}$ and $7^{\circ}$ ), cone from a mountainous tract between the Ucayali and the Javari. The existence of
this tract in so eastern a longitude (probably long. $74^{\circ}$ ), is the more remarkable, as we find at four degrees of latitude further north, neither a rock nor a hill on the east of Xeberos, or the mouth of the Huallaga (long. $77^{\circ} 56^{\prime}$ ).

We have just seen that the spur of Beni, a sort of lateral branch, loses itself about lat. $8^{\circ}$; the chain between the Ucayali and the Huallaga terminates at the parallel of $7^{\circ}$, in joining, on the west of Lamas, the chain of Chachapayas, stretching betwen the Huallaga and the Amazon. Iinally, the latter chain, to which I have given the designation of 'central,' after forming the rapids and cataracts of the Amazon, between Tomependa and San Borja, turns to north-north-west, and joins the western chain, that of Caxamarca, or the Nevados of Pelagatos and Huaylillas, and forms the great knot of the mountains of Loxa. The mean height of this knot is only from 1000 to 1200 toises: its mild climate renders it peculiarly favourable to the growth of the cinchona trees, the finest kinds of which are found in the celebrated forest of Caxanuma and Uritusinga, between the Rio Zamora and the Cachiyacu, and between Tavacona and Guancabamba. Before the cinchona of Popayan and Santa Fe de Bogota (nor. lat. $2 \frac{1}{2}^{\circ}$ to $5^{\circ}$ ), of Huacarachuco, Huamalies, and Huanuco (south lat. $9^{\circ}$ to $11^{\circ}$ ), became known, the group of the mountains of Loxa had for ages been regarded as the sole region whence the febrifuge bark of cinchona could be obtained. This group occupies the vast territory between Guancabamba, Avayaca, Oña, and the ruined towns of Zamora and Loyola, between lat. $5 \frac{1_{2}^{\circ}}{\circ}$ and $3 \frac{1}{4}^{\circ}$. Some of the summits (the Paramos of Alpachaca, Saraguru, Savanilla, Gueringa, Chulucanas, Guamani, and Yamoca, which I measured), rise from 1580 to 1720 toises, but are not even sporadically covered with snow, which in this latitude falls only above 1860 to 1900 toises of absolute height. Eastward, in the direction of the Rio Santiago and the Rio de Chamaya, two tributary streams of the Amazon, the mountains lower rapidly: between San Felipe, Matara, and Jaen de Bracamoros, they are not more than 500 or 300 toises.

As we advance from the mica-slate mountain of Loxa towards the north, between the Paramos of Alpachaca and Sara (in latitude $3^{\circ} 15^{\prime}$ ), the knot of mountains ramifies into two branches, which comprehend the longitudinal

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valley of Cuenca. This separation continues for a length of only 12 leagues; for in latitude $2^{\circ} 27^{\prime}$, the two Cordilleras again re-unite in the knot of Assuy, a trachytic graup, of which the table-land, near Cadlud ( 2428 toises high) nearly enters the region of perpetual snow.

The group of the mountains of Assuy, which affords a very frequented pass of the Andes between Cuenca and Quito (lat. $2 \frac{1}{2}^{\circ}$ to $0^{\circ} 40^{\prime}$ south) is succeeded by another division of the Cordilleras, celebrated by the labours of Bouguer and La Condamine, who placed their signals sometimes on one, sometimes on the other of the two chains. The eastern chain is that of Chimborazo ( 3350 toises) and Carguairazo; the western is the chain of the volcano Sangay, the Collanes, and of Llanganate. The latter is broken by the Rio Pastaza. The bottom of the longitudinal basin that bounds those two chains, from Alausi to Llactacunga, is somewhat higher than the bottom of the basin of Cuenca. North of Llactacanga, $0^{\circ} 40^{\prime}$ latitude, between the tops of Yliniza ( 2717 toises) and Cotopaxi ( 2950 toises), of which the former belongs to the chain of Chimborazo, and the latter to that of Sangay, is situated the knot of Chisinche ; a kind of narrow dyke that closes the basin, and divides the waters between the Atlantic and the Pacific. The Alto de Chisinche is only 80 toises above the surrounding table-lands. The waters of its northern declivity form the Rio de San Pedro, which, joining the Rio Pita, throws itself into the Gualabamba, or Rio de las Esmeraldas. The waters of the southern declivity, called Cerro de Tiopullo, run into the Rio San Felipe and the Pastaza, a tributary stream of the Amazon.

The bipartition of the Cordilleras re-commences and continues from $0^{\circ} 40^{\prime}$ lat. south to $0^{\circ} 20^{\prime}$ lat. north; that is, as far as the volcano of Imbabura, near the villa of Ibarra. The eastern Cordillera presents the snowy summits of Antisana (2992 toises), of Guamani, Cayambe (3070 toises), and of Imbabura; the western Cordillera, those of Corazon, Atacazo, Pichinca ( 2491 toises), and Catocache ( 2570 toises). Between these two chains, which may be regarded as the classic soil of the astronomy of the 18 th century, is a valley, part of which is again divided longitudinally by the hills of Ichimbio and Poignasi. The table-lands of Puembo
and Chillo are situated eastward of those hills; and those of Quito, Iñaquito, and Turubamba lie westward. The equator crosses the summit of the Nevado de Cayambe and the valley of Quito, in the village of San Antonio de Lulumbamba. When we consider the small mass of the knot of Assuy, and above all, of that of Chisinche, we are inclined to regard the three basins of Cuenca, Hambato, and Quito, as one valley (from the Paramo de Sarar to the Villa de Ibarra) 73 sea leagues long, from 4 to 5 leagues broad, having a general direction N. $8^{\circ}$ E., and divided by two transversel dykes one between Alausi and Cuenca ( $2^{\circ} 27^{\prime}$ south latitude), and the other between Machache and Tambillo ( $0^{\circ} 40^{\prime}$ ). Nowhere in the Cordillera of the Andes are there more colossal mountains heaped together, than on the east and west of this vast basin of the province of Quito, one degree and a half south, and a quarter of a degree north of the equator. This basin, which, next to the basin of Titicaca, is the centre of the most ancient native civilization, touches, southward, the knot of the mountains of Loxa, and northward the tableland of the province of Los Pastos.

In this province, a little beyond the villa of Ibarra, between the snowy summits of Cotocache and Imbabura, the two Cordilleras of Quito unite, and form one mass, extending to Meneses and Voisaco, from $0^{\circ} 21^{\prime}$ north lat. to $1^{\circ} 13^{\prime}$. I call this mass, on which are situated the volcanoes of Cumbal and Chiles, the knot of the mountains of Los Pastos, from the name of the province that forms the centre. The volcano of Pasto, the last eruption of which took place in the year 1727, is on the south of Yenoi, near the northern limit of this group, of which the inhabited table-lands are more than 1600 toises above sea-level. It is the Thibet of the equinoctial regions of the New World.

On the north of the town of Pasto (lat. $1^{\circ} 13^{\prime} \mathrm{N}$. ; long. $79^{\circ} 41^{\prime}$ ), the Andes again divide into two branches, and surround the table-land of Mamendoy and Almaguer. The eastern Cordillera contains the Sienega of Sebondoy (an alpine lake which gives birth to the Putumayo), the sources of the Jupura or Caqueta, and the Paramos of Aponte and Iscanse. The western Cordillera, that of Mamacondy, called in the country Cordillera de la Costa, on account of its proximity to the shore of the Pacific, is broken by the great

Rio de Patias, which receives the Guativa, the Guachicon, and the Quilquase. The table-land or intermediary basin has great inequalities; it is partly filled by the Paramos of Pitatumba and Paraguay, and the separation of the two chains appeared to me indistinct as far as the parallel of Almaguer (lat. $1^{\circ} 54^{\prime}$; long. $79^{\circ} 15^{\prime}$ ). The general direction of the Andes, from the extremity of the basin of the province of Quito to the vicinity of Popayan, changes from N. $8^{\circ}$ E. to N. $36^{\circ} \mathrm{E}$. ; and follows the direction of the coast of Esmeralda and Barbacoas.

On the parallel of Almaguer, or rather a little north-east of that town, the geological structure of the ground displays very remarkable changes. The Cordillera, to which we have given the name of 'eastern,' that of the lake of Sebondoy, widens considerably between Pansitara and Ceja. The knot of the Paramo de las Papas and of Socoboni gives birth to the great rivers of Cauca and Magdalena, and is divided into two chains, latitude $2^{\circ} 5^{\prime}$ east and west of La Plata, Vieja, and Timana. These two chains continue nearly parallel as far as $5^{\circ}$ of latitude, and they bound the longitudinal valley through which winds the Rio Magdalena. We shall give the nane of the eastern Cordillera of New Grenada to that chain which stretches towards Santa Fe de Bogota, and the Sierra Nevada de Merida, east of Magdalena; the chain which lies between the Magdalena and the Cauca, in the direction of Mariquita, we will call the central Cordillera of New Grenada; and the chain which continues the Cordillera de la Costa from the basin of Almaguer, and separates the bed of the Rio Cauca from the platiniferous territory of Choco, we will designate the western Cordillera of New Grenada. For additional clearness, we may also name the chain, that of Suma Paz, after the colossal group of mountains on the south of Santa Fe de Bogota, which empties the waters of its eastern declivity into the Rio Meta. The second chain may bear the name of the chain of Guanacas or Quindiu, after the two celebrated passages of the Andes, on the road from Santa Fe de Bogota to Popayan. The third chain may be called the chain of Choco, or of the shore. Some leagues south of Popayan (lat. $2^{\circ} 21^{\prime} \mathrm{N}$.), west of Paramo de Palitara and the volcano of Purace, a ridge of mica-slate runs from the knot of the mountains of

Sacoboni to north-west, and divides the waters between the Pacific and the Caribbean Sea; they flow from the northern declivity into the Rio Cauca, and from the southern declivity, into the Rio de Patias.

The tripartition of the Andes (N. lat. $1 \frac{3}{4}^{\circ}-2 \frac{1}{4}^{\circ}$ ) resem. bles that which takes place at the source of the Amazon in the knot of the mountains of Huanuco and Pasco (lat. $11^{\circ}$ S.) ; but the most western of the three chains that bound the basins of the Amazon and the Huallaga, is the loftiest; while that of Choco, or the shore, is the least elevated of the three chains of New Grenada. Ignorance of this tripartition of the Andes in that part of South America near the Rio Atrato and the isthmus of Panama, has led to many erroneous opinions respecting the possibility of a canal that should connect the two seas.

The eastern chain of the Andes of New Grenada* preserves its parallelisin during some time with the two other chains, those of Quindiu and Choco; but beyond Tunja (lat. $5 \frac{1}{2}^{\circ}$ ) it inclines more towards the north-east, passing somewhat abruptly from the direction N. $25^{\circ} \mathrm{E}$. to that of N. $45^{\circ} \mathrm{E}$. It is like a vein that changes its direction; and it rejoins the coast after being greatly enlarged by the grouping of the snowy mountains of Merida. The tripartition of the Cordilleras, and above all, the spreading of their branches, have a vast influence on the prosperity of the nations of New Grenada. The diversity of the superposed table-lands and climates varies the agricultural productions as well as the character of the inhabitants. It gives activity to the exchange of productions, and renews over a vast surface, north of the equator, the picture of the sultry vallies and cool and temperate plains of Peru. It is also worthy of remark that, by the separation of one of the branches of the Cordilleras of Cundinamarca, and by the deviation of the chain of Bogota towards the north-east, the colossal group of the mountains of Merida is enclosed in the territory of the ancient Capitania-general of Venezuela, and that the continuity of the same mountainous land from Pamplona to Barquesimeto and Nirgua may be said to have facilitated the political union of the Columbian territory. As long as

* I employ a systematic denomination, for the name of the Andes is unknown in the countries situated north of the equator.
the central chain (that of Quindiu) presents its snowy summits, no peak of the eastern chain (that of La Suma Paz) rises, in the same parallels, to the limit of perpetual snow. Between latitude, $2^{\circ}$ and $5 \frac{1}{2}^{\circ}$ neither the Paramos situated on the east of Gigante and Neiva, nor the tops of La Suma Paz, Chingasa, Guachaneque, and Zoraca, exceed the height of 1900 to 2000 toises; while on the north of the parallel of Paramo d'Erve (lat. $5^{\circ} 5^{\prime}$ ), the last of the Nevados of the central Cordillera, we discover in the eastern chain the snowy summits of Chita (lat. $5^{\circ} 50^{\prime}$ ), and of Mucuchies (lat. $8^{\circ} \mathbf{1 2}^{\prime}$ ). Hence it results, that from latitude $5^{\circ}$, the only mountains covered with snow during the whole year, are the Cordilleras of the east; and although the Sierra Nevada of Santa Marta is not, properly speaking, a continuation of the Nevados of Chita and Mucuchies (west of Patute and east of Merida), it is at least very near their meridian.

Having now arrived at the northern extremity of the Cordilleras, comprehended between Cape Horn and the isthmus of Panama, we shall proceed to notice the loftiest summits of the three chains which separate in the knot of the mountains of Socoboni, and the ridge of Roble (lat. $1^{\circ} 50^{\circ}-2^{\circ} 20^{\prime}$ ). I begin with the most eastern chain, that of Timana and Suma Paz, which divides the tributary streams of the Magdalena and the Meta: it runs by the Paramos de Chingasu, Guachaneque, Zoraca, Toquillo (near Labranza Grande), Chita, Almorsadero, Laura, Cacota, Zumbador, and Porqueras, in the direction of the Sierra Nevada de Merida. These Paramos indicate ten partial risings of the back of the Cordilleras. The declivity of the eastern chain is extremely rapid on the eastern side, where it bounds the basin of the Meta and the Orinoco; it is widened on the west by the spurs on which are situated the towns of Santa Fe de Bogota, Tunja, Sogamoso, and Leiva. They are like tablelands fixed to the western declivity, and are from 1300 to 1400 toises high; that of Bogota (the bottom of an ancient lake) contains fossil bones of the mastodon, in the plain called (from them) the Campo de Gigantes, near Suacha.

The intermediary, or central chain, runs east of Popayan, by the high plains of Mabasa, the Paramos- of Guanacas, Huila, Savelillo, Iraca, Baraguan, Tolima, Ruiz, and Herveo,
towards the province of Antioquia. In $5^{\circ} \mathbf{1 5}$ of latitude, this chain, the only one that shews traces of recent volcanic fire, in the summits of Sotara and Purace, widens considerably towards the west, and joins the western chain, which we have called the chain of Choco, because the platiniferous land of that province lies on the slope opposite the Pacific ocean. By the union of the two chains, the basin of the province of Popayan is close on the north of Cartago Viejo; and the river of Cauca, issuing from the plain of Buga, is forced, from the Salto de San Antonio, to La Boca del Espiritu Santo, to open its way across the mountains, along a course of from 40 to 50 leagues. The difference of the level is very remarkable in the bottom of the two parallel basins of Cauca and Magdalena. The former, between Cali and Cantago, is from 500 to 404 toises; the latter, from Neiva to Ambalema, is from 265 to 150 toises high. According to different geological hypotheses, it may be said either that the secondary formations have not accumulated to the same thickness between the eastern and central, as between the central and western chains; or, that the deposits have been made on the base of primitive rocks, unequally upheaved on the east and west of the Andes of Quindiu. The average difference of the thickness of these formations is 300 toises. The rocky ridge of the Angostura of Carare branches from the south-east, from the spur of Muzo, through which winds the Rio Negro. By this spur, and by those that come from the west, the eastern and central chains approach between Nares, Honda, and Mendales. In fact, the bed of the Rio Magdalena is narrowed in $5^{\circ}$ and $5^{\circ} 18^{\prime}$, on the east by the mountains of Sergento, and on the west by the spurs that are linked with the granitic mountains of Maraquito and Santa Ana. This narrowing of the bed of the river is in the same parallel with that of the Cauca, near the Salto de San Antonio; but, in the knot of the mountains of Antioquia the central and western chains join each other, while between Honda and Mendales, the tops of the central and eastern chains are so far removed, that it is only the spurs of each system that draw near and are confounded together. It is also worthy of remark, that the central Cordillera of New Grenada displays the loftiest summit of the Andes in the
northern hemisphere. The peak of Tolima (lat. $4^{\circ} \mathbf{4 6}^{\prime}$ ), which is almost unknown even by name in Europe, and which I measured in 1801, is at least 2865 toises high. It consequently surpasses Imbabura and Cotocache in the province of Quito, the Chiles of the table-lands of Los Pastos, the two volcanos of Popayan, and even the Nevados of Mexico and Mount Saint Elias of Kussian America. The peak of Tolima, which in form resembles Cotapaxi, is perhaps inferior in height only to the ridge of the Sierra Nevada de Santa Marta, which may be considered as an insulated system of mountains.

The eastern chain, also called the chain of Choco and the east coast (of the Pacific), separates the provinces of Popayan and Antioquia from those of Barbacoas, Raposo, and Choco. It is in general but little elevated, compared to the height of the central and eastern chains; it however presents great obstacles to the communications between the valley of Cauca and the shore. On its western slope lies the famous auriferous and platiniferous land,* which has during ages yielded more than 13,000 marks of gold annually. This alluvial zone is from ten to twelve leagues broad; its maximum of productiveness lies between the parallels of $2^{\circ}$ and $6^{\circ}$ lat.; it sensibly impoverishes towards the north and south, and almost entirely disappears between $11^{\circ}$ north lat. and the equator. The auriferous soil fills the basin of Cauca, as well as the ravines and plains west of the Cordillera of Choco; it rises sometimes nearly 600 toises above the level of the sea, and descends at least 40 toises. $\dagger$ Platinum (and tbis fact is worthy of attention) has hitherto been found only on the west of the Cordillera of Choco, and not on the east, notwithstanding the analogy of the fragments of rocks

[^461]of greenstone, phonolite, trachyte, and ferruginous quartz, of which the soil of the two slopes is composed. From the ridge of Los Robles, which separates the table-land of Almaguer from the basin of Cauca, the western chain forms, first, in the Cerros de Carpinteria, east of the Rio San Juan de Micay, the continuation of the Cordillera of Sindagua, broken by the Rio Patias; then, lowering northward, between Cali and Las Juntas de Dagua, and at the elevation of 800 to 900 toises, it sends out considerable spurs (lat. $4 \frac{1}{4}^{\circ}$ to $5^{\circ}$ ) towards the source of the Calima, the Tamana, and the Andagueda. The two former of these auriferous rivers are tributary streams of the Rio San Juan del Choco; the second empties its waters into the Atrato. This widening of the western chain forms the mountainous part of Choco: here, between the Tado and Zitara, called also Francisco de Quibdo, lies the isthmus of Raspadura, across which a monk traced a navigable line of communication between the two oceans. The culminant point of this system of mountains appears to be the Peak of Torra, situated south-east of Novita.

The northern extremity of this enlargement of the Cordillera of Choco, which I have just described, corresponds with the junction formed on the east, between the same Cordillera and the central chain, that of Quindiu. The mountains of Antioquia, on which we have the excellent observations of Mr. Restrepo, may be called a knot of mountains, and on the northern limit of the plains of Buga, or the basin of Cauca, they join the central and western chains. The ridge of the eastern Cordillera is at the distance of thirty-five leagues from this knot, so that the contraction of the bed of the Rio Magdalena, between Honda and Ambalema, is caused only by the approximation of the spurs of Mariquita and Guaduas. There is not, therefore, properly speaking, a group of mountains between lat. $5^{\circ}$ and $5 \frac{1}{4}^{\circ}$, uniting the three chains at once. In the group of the province of Antioquia, which forms the junction of the central and western Cordilleras, we may distinguish two great masses; one between the Magdalena and the Cauca, and the other between the Cauca and the Atrato. The first of these masses, which is linked most immediately to the snowy summits of Herveo, gives birth on the east to the Rio
de la Miel and the Nare; and on the north to Porce and Nechi; its average height is only from 1200 to 1350 toises. The culminant point appears to be near Santa Rosa, southwest of the celebrated Valley of Bears (Valle de Osos). The towns of Rio Negro and Marinilla are built on table-lands 1060 toises high. The western mass of the knot of the mountains of Antioquia, between the Cauca and the Atrato, gives rise, on its western descent, to the Rio San Juan, Bevara, and Murri. It attains its greatest height in the Alto del Viento, north of Urrao, known to the first conquistadores by the name of the Cordilleras of Abide or Dabeida. This height (lat. $7^{\circ} 15^{\prime}$ ) does not, however, exceed 1500 toises. Following the western slope of this system of mountains of Antioquia, we find that the point of partition of the waters that flow towards the Pacific and the Caribbean Sea (lat. $5 \frac{1}{2}^{\circ}$ and $6^{\circ}$ ) nearly corresponds with the parallel of the isthmus of Raspadura, between the Rio San Juan and the Atrato. It is remarkable that in this group, more than 30 leagues broad, without sharp summits, between lat. $5 \frac{1}{4}^{\circ}$ and $7^{\circ}$, the highest masses rise towards the west; while, further south, before the union of the two chains of Quindiu and Choco, we saw them on the east of Cauca.

The ramifications of the knot of Antioquia, on the north of the parallel $7^{\circ}$, are very imperfectly known; it is observed only that their lowering is in general more rapid and complete towards the north-west, in the direction of the ancient province of Biruquete and Darien, than towards the north and north-east, on the side of Zaragoza and Simiti. From the northern bank of the Rio Nare, near its confluence with the Samana, a spur stretches out, known by the name of La Simitarra, and the Mountains of San Lucar. We may call it the first branch of the group of Antioquia. I saw it, in going up the Rio Magdalena, on the west, from the Regidor and the mouth of the Rio Simiti, as far as San Bartolome (on the south of the mouth of the Rio Sogamozo); while, eastward, in lat. $7 \frac{3^{\circ}}{4}$ and $8 \frac{1}{4}^{\circ}$, the spur of the mountains of Ocana appear in the distance; they are inhabited by some tribes of Molitone Indians. The second branch of the group of Antioquia (west of Samitarra) commences at the mountains of Santa Rosa, stretches out between Zaragoza and Caceres, and terminates abruptly at the confluence of the Rio Nechi
(lat. $8^{\circ} 33^{\prime}$ ): at least if the hills, often conical, between the mouth of the Rio Sinu and the small town of Tolu, or even the calcareous heights of Turbaco and Popa, near Carthagena, may not be regarded as the most northern prolongation of this second branch. A third advances towards the gulf of Uraba or Darien, between the Rio San Jorge and the Atrato. It is linked southward with the Alto del Viento, or Sierra de Abide, and is rapidly lost, advancing as far as the parallel of $8^{\circ}$. Finally, the fourth branch of the Andes of Antioquia, situated westward of Zitara and the Rio Atrato, undergoes, long before it enters the isthmus of Panama, such a depression, that between the Gulf of Cupica and the embarcadero of the Rio Naipipi, we find only a plain across which M. Gogueneche has projected a canal for the junction of the two seas. It would be interesting to know the configuration of the strata between Cape Garachine, or the Gulf of St. Miguel, and Cape Tiburon, especially towards the source of the Rio Tuyra and Chucunaque or Chucunque, so as to determine with precision where the mountains of the isthmus of Panama begin to rise; monntains whose elevation does not appear to be more than 100 toises. The interior of Darfúr is not more unknown to geographers than the humid, insalubrious forest-land which extends on the north-west of Betoi and the confluence of the Bevara with the Atrato, towards the isthmus of Panama. All that we positively know of it hitherto is, that between Cupica and the left bank of the Atrato, there is either a land-strait, or a total absence of the Cordillera. The mountains of the isthmus of Panama, by their direction and their geographical position, may be considered as a continuation of the mountains of Antioquia and Choco; but on the west of BasAtrato, there is scarcely a ridge in the plain. We do not find in this country a group of interposed mountains like that which links (between Barquesimeto, Nirgua, and Valencia) the eastern chain of New Grenada (that of Suma Paz and the Sierra Nevada de Merida) to the Cordillera of the shore of Venezuela.

The Cordillera of the Andes, considered in its whole extent, from the rocky wall of the island of Diego Ramirez, to the isthmus of Panama, is sometimes ramified into chains more or less parallel, and sometimes articulated by immense
knots of mountains. We distinguish nine of those knots, and consequently an equal number of branching-points and ramifications. The latter are generally bifurcations. The Andes are twice only divided into three chains; in the knot of Huanuco, near the source of the Amazon, and the Huallaga (lat. $10^{\circ}$ to $11^{\circ}$ ), and in the knot of the Paramo de las Papas (lat. $2^{\circ}$ ), near the source of the Magdalena and the Cauca. Basins, almost shut in at their extremities, parallel with the axis of the Cordillera, and bounded by two knots and two lateral chains, are characteristic features of the structure of the Andes. Among these knots of mountains, some, for instance those of Cuzco, Loxa, and Los Pastos, comprise 3300,1500 , and 1130 square leagues, while others no less important in the eye of the geologist are confined to ridges or transversal dykes. To the latter belong the Altos de Chisinche (lat. $0^{\circ} 40^{\prime}$ south), and the Los Kobles (lat. $2^{\circ} 20^{\prime}$ north), on the south of Quito and Popayan. The knot of Cuzco, so celebrated in the annals of Peruvian civilization, presents an average height of from 1200 to 1400 toises, and a surface nearly three times greater than the whole of Switzerland. The ridge of Chisinche, which separates the basins of Tacunga and Quito, is 1580 toises high, but scarcely a mile broad. The knots or groups which unite several partial chains, have not the highest summits, either in the Andes, or, for the most part, in the great mountain ranges of the old continent; it is not even certain that there is always in those knots a widening of the chain. The greatness of the mass, and the height so long attributed to points whence several considerable branches issue, was founded either on theoretic ideas or on false measures. The Cordilleras were compared to rivers that swell as they receive a number of tributary streams.

Among the basins which the Andes present, and which form probably as many lakes or small inland seas, those of Titicaca, Rio Jauja, and the Upper Marañon, comprise respectively 3500,1300 , and 2400 square leagues of surface.*

[^462]The first is so encompassed that no drop of water can escape except by evaporation; it is like the enclosed valley of Mexico,* and of those numerous circular basins which have been discerned in the moon, and which are surrounded by lofty mountains. An immense alpine lake characterizes the basin of Tiahuanaco or Titicaca; this phenomenon is the more worthy of attention, as in South America there are scarcely any of those reservoirs of fresh water which are found at the foot of the European Alps, on the northern and southern slopes, and which are permanent during the season of drought. The other basins of the Andes, for instance, those of Jauja, the Upper Marañon, and Cauca, pour their waters into natural canals, which may be considered as so many crevices situated either at one of the extremities of the basin, or on its banks, nearly in the middle of the lateral chain. I dwell on this articulated form of the Andes, on those knots or transverse ridges, because, in the continuation of the Andes called the Cordilleras of the shore of Venezuela, we shall find the same transverse dykes, and the same phenomena.

The ramification of the Andes and of all the great masses of mountains into several chains, merits particular consideration in reference to the height more or less considerable of the bottom of the enclosed basins, or longitudinal valleys. Geologists have hitherto directed more attention to the successive narrowing of these basins, their depth compared with the walls of rock that surround them, and the correspondence between the re-entering and the salient angles, than to the level of the bottom of the valleys. No precise measure has yet fixed the absolute height of the three basins of Titicaca,
occupy 23,300 square leagues of this surface, and the three basins contained between lat. $6^{\circ}$ and $20^{\circ}$ south measure 7200 square leagues. Deducting 33,200 square leagues for the whole of the enclosed basins and spurs, we find, in latitude $65^{\circ}$, the area of the Cordilleras elevated in the form of walls, to be 25,700 square leagues, whence results (comprehending the knots, and allowing for the inflexion of the chains) an average breadth of the Andes of 18 to 20 leagues. The valleys of Huallaga and the Rio Magdalena are not comprehended in these 58,900 square leagues, on account of the diverging direction of the chain, east of Cipoplaya and Santa Fe de Bogota.

* We consider it in its primitive state, without respect to the gap or cleft of the mountains, known by the name of Desaghue de Huehuetoca.

Jauja, and the Upper Marañon ;* but I was fortunate enough to be able to determine the six other basins, or longtitudinal valleys, which succeed each other, as if by steps, towards the north. The bottom of the valley of Cuenca, between the knots of Loxa and Assuay, is 1350 toises; the valley of Allansi and of Hambato, between the knot of the Assuay and the ridge of Chisinche, 1320 toises; the valley of Quito in the eastern part, 1340 toises, and in the western part, 1490 toises; the basin of Almaguer, 1160 toises; the basin of the Rio Cauca, between the lofty plains of Cali, Buga, and Cartago, 500 toises; the valley of Magdalena, first between Neiva and Honda, 200 toises; and further on, between Honda and Mompox, 100 toises of average height above the level of the sea. $\dagger$. In this region, which has been carefully measured, the different basins lower very sensibly from the equator northward. The elevation of the bottom of enclosed basins merits great attention in connection with the causes of the formation of the valleys. I do not deny that the depressions in the plains may be sometimes the effect of ancient pelagic currents, or slow erosions. I am inclined to believe that the transversal valleys, re-

[^463]sembling crevices, have been widened by running waters; but these hypotheses of successive erosions cannot well be applied to the completely enclosed basins of Titicaca and Mexico. These basins, as well as those of Jauja, Cuenca, and Almaguer, which lose their waters only by a lateral and narrow issue, owe their origin to a cause more instantaneous, more closely linked with the upheaving of the whole chain. It may be said that the phenomenon of the narrow declivities of the Sarenthal and of the valley of Eysack in the Tyrol, is repeated at every step, and on a grander scale, in the Cordilleras of equinoctial America. We seem to recognize in the Cordilleras those longtitudinal sinkings, those "rocky vaults," which, to use the expression of a great geologist,* " are broken when extended over a great space, and leave deep and almost perpendicular rents."

If, to complete the sketch of the structure of the Andes, from Tierra del Fuego to the northern Polar Sea, we pass the boundaries of South America, we find that the western Cordillera of New Grenada, after a great depression between the mouth of the Atrato and the gulf of Cupica, again rises in the isthmus of Panama to 80 or 100 toises high, augmenting towards the west, in the Cordileras of Veragua and Salamanca, $\dagger$ and extending by Guatimala, as far as the confines of Mexico. Within this space it extends along the coast of the Pacific, where, from the gulf of Nicoya to Soconusco (lat. $9 \frac{1_{2}}{}{ }^{\circ}-16^{\circ}$ ), is found a long series of volcanos, $\ddagger$ most frequently insulated, and sometimes linked to spurs or lateral branches. Passing the isthmus of Tehuantepecor Huasacualco, on the Mexican territory, the Cordillera

[^464]of central America extends on toward the intendancia of Oaxaca, at an equal distance from the two oceans; then from $18 \frac{1^{\circ}}{}{ }^{\circ}$ to $21^{\circ}$ lat. from Misteca to the mines of Zimapan, it approximates to the eastern coast. Nearly in the parallel of the city of Mexico, between Toluca, Xalapa, and Cordoba, it attains its maximum height; several colossal summits rising to 2400 and 2770 toises. Farther north, the chain called Sierra Madre runs N. $40^{\circ}$ W. towards San Miguel el Grande and Guanaxuato. Near the latter town (lat. $21^{\circ} 0^{\prime} 15^{\prime \prime}$ ), where the richest silver mines of the known world are situated, it widens in an extraordinary degree, and separates into three branches. The most eastern branch advances towards Charcas and the Real de Catorce, and lowers progressively (turning to N.E.) in the ancient kingdom of Leon, in the province of Cohahuila and Texas. That branch is prolonged from the Rio Colorado de Texas, crossing the Arkansas near the confluence of the Mississippi and the Missouri (lat. $38^{\circ} 51^{\prime}$ ). In those countries it bears the name of the Mountains of Ozark,* and attains 300 toises of height. It has been supposed that on the east of the Mississippi (lat. $44^{\circ}-46^{\circ}$ ), the Wisconsin Hills, which stretch out to N.N.E. in the direction of Lake Superior, may be a continuation of the mountains of Ozark. Their metallic wealth seems to denote that they are a prolongation of the eastern Cordillera of Mexico. The western branch or Cordillera occupies a part of the province of Guadalajara, and stretches by Culiacan, Aripe, and the auriferous lands of the Pimeria Alta and La Sonora, as far as the banks of the Rio Gila (lat. $33^{\circ}-34^{\circ}$ ), one of the most ancient dwellings of the Aztek nations. We shall soon see that this western chain appears to be linked by the spurs that advance to the west, with the maritime Alps of California. Finally, the central Cordillera of Anahuac, which is
stones, destroyed, on the 11th September, 1541, the Ciudad Vieja, or Almolonga (the ancient capital of the country, which must not be conSounded with the ancient Guatimala), is covered with snow, during several months of the year. This phenomenon would seem to indicate a height of more than 1750 toises.

* Ozark is at once the ancient name of Arkansas, and of the tribe of Quawpaw Indians, who inhabit the banks of that great river. The culminant point of the Mountains of Ozark is in latitude $37 \frac{1}{2}^{\circ}$, between the sources of the White and Osage rivers.
the most elevated, runs first from south-east to north-west, by Zacatecas towards Durango, and afterwards from south to north, by Chihuahua, towards New Mexico. It takes successively the names of Sierra de Acha, Sierra de Los Mimbres, Sierra Verde, and Sierra de las Grullas, and about the $29^{\circ}$ and $30^{\circ}$ of latitude, it is connected by spurs with two lateral chains, those of the Texas and La Sonora, which renders the separation of the chains more imperfect than the trifurcations of the Andes in South America.

That part of the Cordilleras of Mexico which is richest in silver beds and veins, is comprehended between the parallels of Oaxaca and Cosiquiriachi (lat. $16 \frac{1}{2}^{\circ}-29^{\circ}$ ); the alluvial soil that contains disseminated gold, extends some degrees still further northwards. It is a very striking phenomenon, that the gold-washing of Cinaloa and Sonora, like that of Barbacoas and Choco, on the south and north of the isthmus of Panama, is uniformly situated on the west of the central chain, on the descent opposite the Pacific. The traces of a still-burning volcanic fire which was no longer seen, on a length of 200 leagues, from Pasto and Popayan to the gulf of Nicoya (lat. $1 \frac{1}{4}^{\circ}-9 \frac{1}{2}^{\circ}$ ), become very frequent on the western coast of Guatimala (lat. $9 \frac{1}{2}^{\circ}-16^{\circ}$ ) ; these traces of fire again cease in the gneiss-granite mountains of Oaxaca, and re-appear, perhaps for the last time, towards the north, in the central Cordillera of Anahuac, between lat. $18 \frac{1}{4}^{\circ}$ and $19 \frac{1}{2}^{\circ}$, where the volcanoes of Taxtla, Orizaba, Popocatepetl, Toluca, Jorullo, and Colima, appear to be situated in a crevice* extending from E.S.E. to W.N.W., from one ocean to the other. This line of summits, several of which enter the limit of perpetual snow, and which are the loftiest of the Cordilleras from the penk of Tolima (lat. $40^{\circ} 46^{\prime}$ north), is almost perpendicular to the great axis of the chain of Guatimala and Anahuac, advancing to the 27 th parallel, uniformly N. $42^{\circ}$ E. A characteristic feature of every

[^465]knot, or widening of the Cordilleras, is that the grouping of the summits is independent of the general direction of the axis. The backs of the mountains in New Spain form very elevated plains, along which carriages can roll for an extent of 400 leagues, from the capital to Santa-Fe and Taos, near the sources of Rio del Norte. This immense table-land, in $19^{\circ}$ and $24 \frac{1}{2}^{\circ}$ is constantly at the height of from 950 to 1200 toises, that is, at the elevation of the passes of the Great Saint Bernard and the Splügen. We find on the back of the Cordilleras of Anahuac, which lower progressively from the city of Mexico towards Taos, a succession of basins: they are separated by hills little striking to the eye of the traveller because they rise only from 250 to 400 toises above the surrounding plains. The basins are sometimes closed, like the valley of Tenochtitlan, where lie the great. Alpine lakes, and sometimes they exhibit traces of ancient ejections, destitute of water.

Between lat. $33^{\circ}$ and $38^{\circ}$, the Rio del Norte forms, in its upper course, a great longitudinal valley; and the central chain seems here to be divided into several parallel ranges. This distribution continues northward, in the Rocky Mountains,* where, between the parallels of $37^{\circ}$ and $41^{\circ}$, several summits covered with eternal snow (Spanish Peak, James Peak, and Big Horn), are from 1600 to 1870 toises of absolute height. Towards lat. $40^{\circ}$ south of the sources of the Paduca, a tributary of the Rio de la Plata, a branch known by the name of the Black Hills, detaches itself towards the north-east from the central chain. The Rocky Mountains at first seem to lower considerably in $46^{\circ}$ and $48^{\circ}$; and then rise to $48^{\circ}$ and $49^{\circ}$, where their tops are from 1200 to 1300 toises, and their ridge near 950 toises. Between the sources of the Missouri and the River Lewis, one of the tributaries of the Oregon or Columbia, the Cordilleras form in widening, an elbow resembling the knot of Cuzco. There, also, on the eastern declivity of the Rocky Mountains, is the partition of water between the Caribbean Sea and the Polar Sea. This point corresponds with those in the Andes of South America, at the spur of Cochabamba, on the east, lat. $19^{\circ} 20^{\prime}$ south;

[^466]and in the Alto de los Robles (lat. $2^{\circ} 20^{\prime}$ north), on the west. The ridge that separates the Rocky Mountains extends from west to east, towards Lake Superior, between the basins of the Missouri and those of Lake Winnipeg and the Slave Lake. The central Cordillera of Mexico and the Rocky Mountains follow the direction N. $10^{\circ}$ W., from lat. $25^{\circ}$ to $38^{\circ}$; the chain from that point to the Polar Sea prolongs in the direction N. $24^{\circ} \mathrm{W}$., and ends in the parallel $69^{\circ}$, at the mouth of the Mackenzie River.*

In thus developing the structure of the Cordilleras of the Andes from $56^{\circ}$ south to beyond the Arctic circle, we see that its northern extremity (long. $130^{\circ} 30^{\prime}$ ), is nearly $61^{\circ}$ of longitude west of its southern extremity (long. $60^{\circ} 40^{\prime}$ ); this is the effect of the long-continued direction from S.E. to N.W. north of the isthmus of Panama. By the extraordinary breadth of the New Continent, in the $30^{\circ}$ and $60^{\circ}$ north lat., the Cordillera of the Andes, continually approaching nearer to the western coast in the southern hemisphere, is remored 400 leagues on the north from the source of the Rio de la Paz. The Andes of Chile may be considered as maritime Alps, $\dagger$ while, in their most northern continuation, the Rocky Mountains are a chain in the interior of a continent. There is, no doubt, between latitude $23^{\circ}$ and $60^{\circ}$, from Cape Saint Lucas in California, to Alaska on the western coast of the Sea of Kamschatka, a real littoral Cordillera; but it forms a system of mountains almost entirely distinct from the Andes of Mexico and Canada. This system, which we shall call the Cordillera of California, or of New Albion, is linked between lat. $33^{\circ}$ and $34^{\circ}$ with the Pimeria alta, and the western branch of the Cordilleras of Anahuac; and between lat. $45^{\circ}$ and $53^{\circ}$, with the Rocky Mountains, by transversal ridges

> * The eastern boundary of the Rocky Mountains lies-
> In $38^{\circ}$ latitude ............................... $107^{\circ} 20^{\prime}$ longitude. $40^{\circ}$........................................... $108^{\circ} 30^{\prime}$ $63^{\circ}$.......................................... $124^{\circ} 40^{\prime}$ $68^{\circ}$........................................... $130^{\circ} 30^{\prime}$
$\dagger$ Geognostically speaking, a littoral chain is not a range of mountains forming of itself the coast; this name is extended to a chain separated from the coast by a narrow plain.
and spurs that widen towards the east. Travellers who may at some future time pass over the unknown land between Cape Mendocino and the source of the Rio Colorado, may perhaps inform us whether the connexion of the maritime Alps of California or New Albion, with the western branch of the Cordilleras of Mexico, resembles that, which, notwithstanding the depression, or rather total interruption observed on the west of the Rio Atrato, is admitted by geographers to exist between the mountains of the isthmus of Panama and the western branch of the Andes of New Grenada. The maritime Alps, in the peninsula of Old California, rise progressively towards the north in the Sierra of Santa Lucia (lat. $34 \frac{1}{2}^{\circ}$ ), in the Sierra of San Marcos (lat. $37^{\circ}-38^{\circ}$ ), and in the Snowy Mountains near Cape Mendocino (lat. $39^{\circ} 41^{\circ}$ ); the last seem to attain at least the height of 1500 toises. From Cape Mendocino, the chain follows the coast of the Pacific, but at the distance of from twenty to twenty-five leagues. Between the lofty summits of Mount Hood and Mount Saint Helen, in lat. $45 \frac{3}{3}^{\circ}$, the chain is broken by the River Columbia. In New Hanover, New Cornwall, and New Norfolk, these rents of a rocky coast are repeated, these geologic phenomena of the fjords that characterize western Patagonia and Norway. At the point where the Cordillera turns towards the west (lat. $58 \frac{3}{4}^{\circ}$ long. $139^{\circ} 40^{\prime}$ ) there are two volcanic peaks, one of which (Mount Saint Elias) perhaps equals Cotopaxi in height; the other (Fair-Weather Mountain) equals the height of Mount Rosa. The elevation of the former exceeds all the summits of the Cordilleras of Mexico and the Rocky Mountains, north of the parallel $19 \frac{1}{4}^{\circ}$; it is even the culminant point in the northern hemisphere, of the the whole known world north of $50^{\circ}$ degrees of latitude. North-west or the peaks of Saint Elias and Fair-Weather the chain of California widens considerably in the interior of Russian America. Volcanoes multiply in number as we advance westward, in the peninsula of Alaska and the Fox Islands, where the volcano Ajagedan rises to the height of 1175 toises above the level of the sea. Thus the chain of the maritime Alps of California appears to be undermined by subterraneous fires at its two extremities; on the north in $60^{\circ}$ of latitude, and on the south, in $28^{\circ}$, in the
volcanoes of the Virgins.* If it were certain that the mountains of California belong to the western branch of tho Andes of Anahuac, it might be said that the volcanic fire, still burning, abandons the central Cordillera when it recedes from the coast, that is, from the volcano of Colima; and that the fire is borne on the north-west by the peninsula of Old California, Mount Saint Elias, and the peninsula of Alaska, towards the Aleutian Islands and Kamschatka.

I shall terminate this sketch of the structure of the Andes by recapitulating the principal features that characterize the Cordilleras, north-west of Darien.

Lat. $8^{\circ}-11^{\circ}$. Mountains of the isthmus of Panama, Veragua, and Costa Rica, slightly linked to the western chain of New Grenada, which is that of Choco.

Lat. $11^{\circ}-16^{\circ}$. Mountains of Nicaragua and Guatimala; line of volcanoes N. $50^{\circ} \mathrm{W}$., for the most part still burning, from the gulf of Nicoya to the volcano of Soconusco.

Lat. $16^{\circ} 18^{\circ}$. Mountains of gneiss-granite in the province of Oaxaca.

Lat. $18 \frac{1}{2}^{\circ}-19 \frac{1}{2}^{\circ}$. Trachytic knot of Anahuac, parallel with the Nevados and the burning volcanoes of Mexico.

Lat. $19 \frac{1}{2}^{\circ}-20^{\circ}$. Knot of the metaliferous mountains of Guanaxuato and Zacatecas.
Lat. 21 $\frac{3}{4}-22^{\prime}$. Division of the Andes of Anahuac into three chains:
Eastern chain (that of Potosi and Texas), continued by the Ozark and Winconsin mountains, as far as Lake Superior.
Central chain (of Durango, New Mexico, and the Rocky Mountains), sending on the north of the source of the river Platte (lat. $42^{\circ}$ ), a branch (the Black Hills) to N.E., widening greatly between the parallels $46^{\circ}$ and $50^{\circ}$, and lowering progressively as it approaches the mouth of Mackenzie River (lat. $68^{\circ}$ ).
Western chain (of Cinaloa and Sonora). Linked by spurs to the maritime Alps, or mountains of California.
We have yet no means of judging with precision the elevation of the Andes south of the knot of the mountains

[^467]of Loxa (south lat. $3^{\circ} 5^{\circ}$ ); but we know that on the north of that knot, the Cordilleras rise five times higher than the majestic elevation of 2600 toises:

In the group of Quito, $0^{\circ}$ to $2^{\circ}$ south lat. (Chimborazo, Antisano, Cayambe, Cotopaxi, Collanes, Yliniza, Sangay, Tungurahua.)
In the group of Cundinamarca, lat. $4 \frac{30}{4}$ north (peak of Tolima, north of the Andes of Quindiu).
In the group of Anahuac, from lat. $18^{\circ} 59^{\prime}$ to $19^{\circ} 12^{\prime}$ (Popocatepetl or the Great Volcano of Mexico, and Peak of Orizaba). If we consider the maritime Alps or mountains of California and New Norfolk, either as a continuation of the western chain of Mexico, that of Sonora, or as being linked by spurs to the central chain, that of the Rocky Mountains, we may add to the three preceding groups :
The group of Russian America, rom lat. $60^{\circ}$ to $70^{\circ}$ (Mount Saint Elias). Over an extent of $63^{\circ}$ of latitude, I know only twelve summits of the Andes which reach the height of 2600 toises, and consequently exceed by 140 toises, the height of Mont Blanc. Only three of these twelve summits are situated north of the isthmus of Panama.
II. Insulated Group of the Snowy Mountains of Santa Marta. In the enumeration of the different systems of mountains, I place this group before the littoral chain of Venezuela, though the latter, being a northern prolongation of the Cordillera of Cundinamarca, is immediately linked with the chain of the Andes. The Sierra Nevado of Santa Marta is encompassed within two divergent branches of the Andes, that of Bogota, and that of the isthmus of Panama. It rises abruptly like a fortified castle, amidst the plains extending from the gulf of Darien, by the mouth of the Magdalena, to the lake of Maracaybo. The old geographers erroneously considered this insulated group of mountains covered with eternal snow, as the extremity of the high Cordilleras of Chita and Pamplona. The loftiest ridge of the Sierra Nevada de Santa Marta is only three or four leagues in length from east to west; it is bounded (at nine leagues distance from the coast), by the
meridians of the capes of San Diego and San Augustin. The culminant points, called El Picacho and Horqueta, are near the western border of the group; they are entirely separated from the peak of San Lorenzo, also covered with eternal snow, but only four leagues distant from the port of Santa Marta, towards the S.E. I saw this latter peak from the heights that surrounded the village of Turbaco, south of Carthagena. No precise measurement has hitherto given us the height of the Sierra Nevada, which Dampier affirms to be one of the highest mountains of the northern hemisphere. Calculations founded on the maximum of distance at which the group is discerned at sea, give a height of more than 3004 toises. That the group of the mountains of Santa Marta is insulated is proved by the hot climate of the lands (tierras calientes) that surround it. Low ridges and a succession of hills indicate, perhaps, an ancient connection between the Sierra Nevada de Santa Marta on one side, by the Alto de las Minas, with the phonolitic and granitic rocks of the Peñon and Banca,and on the other, by the Sierra de Perija, with the mountains of Chiliguana and Ocaña, which are the spurs of the eastern chain of the Andes of New Grenada. In this latter chain, the febrifuge species of cinchona (corollis hirsutis, staminibus inclusis) are found in the Sierra Nevada de Merida; but the real cinchona, the most northern of South America, is found in the temperate region of the Sierra Nevada de Santa Marta.
III. Littoral Chats of Venezuela.-This is the system of mountains the configuration and direction of which have excited so powerful an influence on the cultivation and commerce of the ancient Capitania General of Venezuela. It bears different names, as the mountains of Coro, of Caracas, of the Bergantin, of Barcelona, of Cumana, and of Paria; but all these names belong to the same chain, of which the northern part runs along the coast of the Caribbean Sea. This system of mountains, which is 160 leagues long,* is a prolongation of the eastern Cordillera of the Andes of Cundinamarca. There is an immediate connection

[^468]of the littoral chain with the Andes, like that of the Pyrenees with the mountains of Asturia and Galicia; it is not the effect of transversal ridges, like the connection of the Pyrenees with the Swiss Alps, by the Black Mountain and the Cevennes. The points of junction are between Truxillo and the lake of Valencia.

The eastern chain of New Grenada stretches N.E. by the Sierra Nevada de Merida, as well as by the four Paramos of Timotes, Niquitao, Bocono, and Las Rosas, of which the absolute height cannot be less than from 1400 to 1600 toises. After the Paramo of Las Rosas, which is more elevated than the two preceding, there is a great depression, and we no longer see a distinct chain or ridge, but merely hills, and high table-lands surrounding the towns of Tocuyo and Barquisimeto. We know not the height even of Cerro del Altar, between Tocuyo and Caranacatu; but we know by recent measures that the most inhabited spots are from 300 to 350 toises above sea-level. The limits of the mountainous land between Tocuyo and the vallies of Aragua are, the plans of San Carlos on the south, and the Rio Tocuyo on the north; the Rio Siquisique flows into that river. From the Cerro del Altar on the N.E. towards Guigue and Valencia, succeed, as culminant points, the mountains of Santa Maria (between Buria and Nirgua); then the Picacho de Nirgua, supposed to be 600 toises high; and finally Las Palomeras and El Torito (between Valencia and Nirgua). The line of water-partition runs from west to east, from Quibor to the lofty savannahs of London, near Santa Rosa. The waters flow on the north, towards the Golfo triste of the Caribbean Sea; and on the south, towards the basins of the Apure and the Orinoco. The whole of this mountainous country, by which the littoral chain of Caracas is linked to the Cordilleras of Cundinamarca, was celebrated in Europe in the middle of the nineteenth century; for that part of the territory formed of gneiss-granite, and lying between the Rio Tocuyo and the Rio Yaracui, contains the auriferous veins of Buria, and the copper-mine of Aroa, which is worked at the present day. If, across the knot of the mountains of Barquisimeto, we trace the meridians of Aroa, Nirgua, and San Carlos, we find that on the N.W. that knot is linked with the Sierra de Coro, and on the N.E. with the
mountains of Capadare, Porto Cabello, and the Villa de Cura. It may be said to form the eastern wall of that vast circular depression of which the lake of Maracaybo is the centre and which is bounded on the south and west by the mountains of Merida, Ocaña, Perija, and Santa Marta.

The littoral chain of Venezuela presents towards the centre, and the east, the same phenomena of structure as those observed in the Andes of Peru and New Grenada; namely, the division into several parallel ranges, and the frequency of longitudinal basins or vallies. But the irruptions of the Caribbean Sea having apparently overwhelmed, at a very remote period, a part of the mountains of the shore, the ranges or partial chains are interrupted, and some basins have become oceanic gulfs. To comprehend the Cordillera of Venezuela in mass, we must carefully study the direction and windings of the coast from Punta Tucacas (west of Porto Cabello), as far as Punta de la Galera of the island of Trinidad. That island, those of Los Testigos, Marguerita, and Tortuga, constitute, with the mica-slates of the peninsula of Araya, one and the same system of mountains. The granitic rocks which appear between Buria, Duaca, and Aroa, cross the valley of the Rio Yaracui, and draw near the shore, whence they extend, like a continuous wall, from Porto Cabello to Cape Codera. This prolongation forms the northern chain of the Cordillera of Venezuela, and is traversed in going from south to north, either from Valencia and the vallies of Aragua, to Burburata and Turiamo, or from Caracas to La Guayra. Hot springs*

[^469]issue from those mountains, those of Las Trincheras ( $90 \cdot 4^{\circ}$ ) on its southern slope, and those of Onoto and Mariara on its southern slope. The former issue from a granite with large grains, very regularly stratified; the latter from a rock of gneiss. What especially characterizes the northern chain, is a summit which is not only the loftiest of the system of the mountains of Venezuela, but of all South America, on the east of the Andes. The eastern summit of the Silla of Caracas, according to my barometric measurement made in 1800, is 1350 toises high,* and notwithstanding the commotion which took place on the Silla during the great earthquake of Caracas, that mountain did not sink 50 or 60 toises, as some North American journals asserted. Four or five leagues south of the northern chain (that of Mariara, la Silla, and Cape Codera,) the mountains of Guiripa, Ocumare, and Panaquire, form the southern chain of the coast, which stretches in a parallel direction from Guigue to the mouth of the Rio Tuy, by the Guesta of Yusma, and the Guacimo. The latitudes of the Villa de Cura and San Juan, so erroneously marked on our maps, enabled me to ascertain the mean breadth of the whole Cordillera of Venezuela. Ten or twelve leagues may be reckoned as the distance from the descent of the northern chain which bounds the Caribbean Sea, to the descent of the southern chain bounding the immense basin of the Llanos. This latter chain, which also bears the name of the Inland Mountains, is much lower than the northern chain; and I can hardly believe that the Sierra de Guayraima attains the height of 1200 toises.

The two partial chains, that of the interior, and that
only $44.5^{\circ}$, and the bubbles of air which are disengaged at intervals, are at Onoto, as well as in the thermal waters of Mariara, pure nitrogen. The waters of Mariara (244 toises) have a faint smell of sulphuretted hydrogen; they leave, by evaporation, a slight residuum, that yields carbonic acid, sulphuric acid, soda, magnesia, and lime. The quantities are so small that the water is altogether without taste. In the course of my journey, I found only the springs of Cumangillas hotter than the thermal waters of Las Trincheras: they are situated on the south of Porto Cabello. The waters of Comangillas are at the height of 1040 toises, and are alike remarkable for their purity, and their temperature of $96.3^{\circ}$ cent.

* The Silla of Caracas is only 80 toises lower than the Canigou in the Pyrenees.

Which runs along the coast, are linked by a ridge or knot of mountains known by the names of Altos de las Cocuyzas ( 845 toises) and the Higuerote ( 835 toises between Los Teques and La Victoria) in lon. $69^{\circ} 30^{\prime}$ and $69^{\circ} 50^{\prime}$. On the west of this ridge lies the enclosed basin* of the lake of Valencia or the Valles de Aragua; and on the east, the basin of Caracas and of the Rio Tuy. The bottom of the firstmentioned basins is between 220 and 250 toises high; the bottom of the latter is 460 toises above the level of the Caribbean Sea. It follows from these measures, that the most western of the two longitudinal vallies enclosed by the littoral Cordillers is the deepest; while in the plains near the Apure and the Orinoco, the declivity is from west to east; but we must not forget that the peculiar disposition of the bottom of the two basins, which are bounded by two parallel chains, is a local phenomenon altogether separato from the causes on which the general structure of the country depends. The eastern basin of the Cordillera of Venezuela is not shut up like the basin of Valencia. It is in the knot of the mountains of Las Cocuyzas, and of Higuerote, that the Serrania de los Teques and Oripoto, stretching eastward, form two valleys, those of the Rio Guayre and Rio Tuy; the former contains the town of Caracas, and both unite below the Caurimare. The Rio Tuy runs through the rest of the basin, from west to east, as far as its mouth, which is situated on the north of the mountains of Panaquire.

Cape Codera seems to terminate the northern range of the littoral mountains of Venezuela, but this termination is only apparent. The coast forms a vast nook, thirty-five sea leagues in length, at the bottom of which is the mouth of the Rio Unare, and the road of Nueva Barcelona. Stretching first from west to east, in the parallel of $10^{\circ} 37^{\prime}$, this

[^470]coast recedes at the parallel $10^{\circ} 6^{\prime}$, and resumes its original direction ( $10^{\circ} 37^{\prime}-10^{\circ} 44^{\prime}$ ) from the western extremity of the peninsula of Araya, to the eastern extremities of Montaña de Paria and the island of Trinidad. From this dissection of the coast, it follows that the range of mountains bordering the shore of the provinces of Caracas and Barcelona, between the meridian $66^{\circ} 32^{\prime}$ and $68^{\circ} 29^{\prime}$, (which I saw on the south of the bay of Higuerote and on the north of the Llanos of Pao and Cachipo, must be considered as the continuation of the southern chain of Venezuela, and as being linked on the west with the Sierras de Panaquire and Ocumare. It may, therefore, be said that between Cape Codera and Cariaco, the inland chain itself forms the coast. This range of very low mountains, often interrupted from the mouth of the Rio Tuy to that of the Rio Neveri, rises abruptly on the east of Nueva Barcelona, first in the rocky island of Chimanas, and then in the Cerro del Bergantin, elevated probably more than 800 toises, but of which the astronomical position and the precise height are yet alike unknown. On the meridian of Cumana the northern chain (that of Cape Codera and the Silla of Caracas) again appears. The micaceous slate of the peninsula of Araya and Maniquarez joins by the ridge or knot of mountains of Meapire the southern chain, that of Panaquire the Bergantin, Turimiquiri, Caripe, and Guacharo. This ridge, not more than 200 toises of absolute height, has, in the ancient revolutions of our planet, prevented the irruption of the ocean, and the union of the gulfs of Paria and Cariaco. On the west of Cape Codera, the northern chain, composed of primitive granitic rocks, presents the loftiest summits of the whole Cordillera of Venezuela; but the culminant points east of that cape, are composed in the southern chain, of secondary calcareous rocks. We have seen above, that the peak of Turimiquiri, at the back of the Cocollar, is 1050 toises, while the bottom of the high valleys of the convent of Caripe, and of Guardia de San Augustin, are 412 and 533 toises of absolute height. On the east of the ridge of Meapire, the southern chain sinks abruptly towards the Rio Arco and the Guarapiche; but, on quitting the main land, we again see it rising on the southern coast of the island of Trinidad, which is but a detached portion of the continent, and of which the
northern side unquestionably presents the vestiges of the northern chain of Venezuela, that is, of the Montaña de Paria (the 'Paradise' of Christopher Columbus), the peninsula of Araya, and the Silln of Caracas. The observations of latitude I made at the Villa de Cura ( $10^{\circ} 2^{\prime} 47^{\prime \prime}$ ), the farm of Cocollar ( $10^{\circ} 9^{\prime} 37^{\prime \prime}$ ), and the convent of Caripe $10^{\circ} 10^{\prime} 14^{\prime \prime}$ ), compared with the more anciently known position of the south coast of Trinidad (lat. $10^{\circ} 6^{\prime}$ ), prove that the southern chain, south of the basins of Valencia and of Tuy* and of the gulfs of Cariaco and Paria, is still more uniform in the direction from west to east than the northern chain from Porto Cabello to Punta Galera. It is highly important to know the southern limit of the littoral Cordillera of Venezuela, because it determines the parallel at which the Llanos or the savannahs of Caracas, Barcelona, and Cumana begin. On some well-known maps, we find erroneously marked between the meridians of Caracas and Cumana, two Cordilleras stretching from north to south, as far as latitude $8 \frac{30}{4}$, under the names of Cerros de Alta Gracia, and del Bergantin, thus describing as mountainous a territory of 25 leagues broad, where we should seek in vain a hillock of a few feet in height.

Turning to the island of Marguerita, composed, like the peninsula of Araya, of micaceous slate, and anciently linked with that peninsula by the Morro de Chacopata and the islands of Coche and Cubagua, we seem to recognize in the two mountainous groups of Macanao aṅ La Vega de San Juan, traces of a third coast-chain of the Cordillera of Venezuela. Do these two groups of Marguerita, of which the most westerly is above 600 toises high, belong to a submarine chain stretching by the isle of Tortuga, towards the Sierra de Santa Lucia de Coro, on the parallel of $11^{\circ}$ ? Must we admit, that in lat. $11 \frac{1}{4}^{\circ}$ and $12 \frac{1}{2}^{\circ}$, a fourth chain, the most northerly of all, formerly stretched out in the direction of the island of Hermanos, by Blanquilla, Los Roques, Orchila, Aves, Buen Ayre, Curaçao, and Oruba,

[^471]towards Cape Chichivacoa? These important problems can only be solved when the chain of islands parallel with the coast has been properly examined. It must not be forgotten, that a great irruption of the ocean appears to have taken place between Trinidad and Grenada,* and that no where else in the long series of the Lesser Antilles are two neighbouring islands so far removed from each other. We observe the effect of the rotatory current in the direction of the coast of Trinidad, as in the coasts of the provinces of Cumana and Caracas, between Cape Paria and Punta Araya, and between Cape Codera and Porto Cabello. If a part of the continent has been overwhelmed by the ocean on the north of the peninsula of Araya, it is probable that the enormous shoal which surrounds Cubagua, Coche, the island of Marguerita, Los Frailes, La Sola, and the Testigos, marks the extent and outline of the submerged land. This shoal or placer, which is of the extent of 200 square leagues, is well known only to the tribe of the Guayqueries; it is frequented by these Indians on account of its abundant fishery in calm weather. The Gran Placer is believed to be separated only by sorie canals or deep furrows of the bank of Grenada from the sand-bank that extends like a narrow dyke from Tobago to Grenada, and which is known by the lowering of the temperature of the water, and from the sand-banks of Los Roques and Aves. The Guayquerie Indians, and, generally speaking, all the inhabitants of the coast of Cumana and Barcelona, are imbued with an idea that the water of the shoals of Marguerita and the Testigos diminishes from year to year; they believe that, in the lapse of ages, the Morro de Chacopata, on the peninsula of Araya, will be joined by a neck of land to the islands of Lobos and Coche. The partial retreat of the waters on the coast of Cumana is undeniable, and the bottom of the sea has been upheaved at various times by earthquakes; but these local phenomena, which it is so difficult to account for by the

[^472]action of volcanic force, the changes in the direction of currents, and the consequent swelling of the waters, are very different from the effects manifested at once over the space of several hundred square leagues.
IV. Group of the Mountatns of Parime.-It is essential to mineralogical geography, to designate by one name all the mountains that form one system. To attain this end, a denomination belonging to a partial group only may be extended over the whole chain; or a name may be employed, which, by reason of its novelty, is not likely to give rise to homogenic mistakes. Mountaineers designate every group by a special denomination; and a chain is generally considered as forming a whole only when it is seen from afar bounding the horizon of the plains. We find the name of 'snowy mountains' (Himalaya, Imaus) repeated in every zone, 'white' (Alpes, Alb), 'black,' and ' blue.' The greater part of the Sierra Parime is, as it were, edged round by the Orinoco. I have, however, avoided a denomination having reference to this circumstance, because the group of mountains to which I am about to direct attention extends far beyond the banks of the Orinoco. It stretches south-east, towards the banks of the Rio Negro and the Rio Branco, to the parallel of $1 \frac{1}{2}^{\circ}$ north latitude. The geographical name of Parime has the advantage of reviving recollections of the fable of El Dorado, and the lofty mountains which, in the sixteenth century, were supposed to surround the lake Rupunuwini, or the Laguna de Parime. The missionaries of the Orinoco still give the name of Parime to the whole of the vast mountainous country comprehended between the sources of the Erevato, the Orinoco, the Caroni, the Rio Parime* (a tributary of the Rio Branco), and the Rupunuri or Rupunuwini, a tributary of the Rio Essequibo. This country is one of the least known parts of South America, and is covered with thick forests and savannahs; it is inhabited by independent Indians, and is intersected by rivers of dangerous navigation, owing to the frequency of shoals and cataracts.

[^473]The system of the mountains of Parime separates the plains of the Lower Orinoco from those of the Rio Negro and the Amazon; it occupies a territory of trapezoidal form. comprehended between the parallels of $3^{\circ}$ and $8^{\circ}$, and the meridians of $61^{\circ}$ and $70 \frac{1}{2}^{\circ}$. I here indicate only the elements of the loftiest group, for we shall soon see that towards south-east, the mountainous country, in lowering, draws near the equator, as well as to French and Portuguese Guiana. The Sierra Parime extends most in the direction N. $85^{\circ}$ W., and the partial chains into which it separates on the westward generally follow the same direction. It is less a Cordillera or a continuous chain in the sense given to those denominations when applied to the Andes and Caucasus, than an irregular grouping of mountains separated the one from the other by plains and savannahs. I visited the northern, western, and southern parts of the Sierra Parime, which is remarkable by its position and its extent of more than 25,000 square leagues. From the confluence of the Apure, as far as the delta of the Orinoco, it is uniformly three or four leagues removed from the right bank of the great river; only some rocks of gneiss-granite, amphibolic slate, and greenstone advance as far as the bed of the Orinoco, and create the rapids of Torno and of La Boca del Infierno.* I shall name successively, from N.N.E. to S.S.W., the different chains seen by M. Bonpland and myself as we approached the equator and the river Amazon. 1st. The most northern chain of the whole system of the mountains of Parime, appeared to us to be that which stretches (lat. $7^{\circ} 50^{\prime}$ ) from the Rio Arui, in the meridian of the rapids of Camiseta, at the back of the town of Angostura, towards the great cataracts of the Rio Carony and the sources of the Imataca. In the missions of the Catalonian Capuchins, this chain, which is not 300 toises high, separates the tributary streams of the Orinoco and those of the Rio Cuyuni, between the town of Upata, Cupapui, and Santa Marta. Westward of the meridian of the rapids of Camiseta (long.

[^474]$67^{\circ} 10^{\prime}$ ), the high mountains in the basin of the Rio Caura only commence at $7^{\circ} 20^{\prime}$ of latitude, on the south of the mission of San Luis Guaraguaraico, where they occasion the rapids of Mura. This chain stretches westward by the sources of the Rio Cuchivero, the Cerros del Mato, the Cerbatana and Maniapure, as far as Tepupano, a group of strangely-formed granitic rocks surrounding the Encaramada. The culminant points of this chain (lat. $7^{\circ} 10^{\prime}-7^{\circ} 28^{\prime}$ ) are, according to the information I gathered from the Indians, situated near the sources of Caño de la Tortuga. In the chain of the Encaramada there are some traces of gold. This chain is also celebrated in the mythology of the Tamanacs; for the painted rocks it contains are associated with ancient local traditions. The Orinoco changes its direction at the confluence of the Apure, breaking a part of the chain of the Encaramada. The latter mountains and scattered rocks in the plain of the Capuchino, and on the north of Cabruta, may be considered either as the vestiges of a destroyed spur, or (on the hypothesis of the igneous origin of granite) as partial eruptions and upheavings. I shall not here discuss the question, whether the most northerly chain, that of Angostura and of the great fall of Carony, be a continuation of the chain of Encaramada. 3rd. In navigating the Orinoco from north to south, we observe, alternately, on the east, small plains and chains of mountains, of which we cannot distinguish the profiles, that is, the sections perpendicular to their longitudinal axes. From the mission of the Encaramada to the mouth of the Rio Qama, I counted seven recurrences of this alternation of savannahs and high mountains. First, on the south of the isle Cucuruparu rises the chain of Chaviripe (lat. $7^{\circ} 10^{\prime}$ ); it stretches, inclining towards the south (lat. $6^{\circ} 20^{\prime}-6^{\circ} 40^{\prime}$ ), by the Cerros del Corozal, the Amoco, and the Murcielago, as far as the Erevato, a tributary of the Caura. It there forms the rapids of Paru, and is linked with the summits of Matacuna. 4th. The chain of Chaviripe is succeeded by that of the Baraguan (lat. $6^{\circ} 50^{\prime}-7^{\circ} 5^{\prime}$ ), celebrated for the strait of the Orinoco, to which it gives its name. The Saraguaca, or mountain of Uruana, composed of detached blocks of granite, may be regarded as a northern spur of the chain of the Baraguan, stretching south-west towards VOL. III.

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Siamacu, and the mountains (lat. $5^{\circ} 50$ ) that separate the sources of the Erevato and the Caura from those of the Ventuari. 5th. The chain of Carichana and of Paruaci (lat. $6^{\circ} 25^{\prime}$ ), wild in aspect, but surrounded by charming meadows. Piles of granite crowned with trees, and insulated rocks of prismatic form (the Mogote of Cocuyza and the Marimaruta or Castillito of the Jesuits), belong to this chain. 6th. On the western bank of the Orinoco, which is low and flat, the Peak of Uniana rises abruptly more than 3000 feet high. The spurs (lat. $5^{\circ} 35^{\prime}-5^{\circ} 40^{\prime}$ ) which this peak sends eastward are crossed by the Orinoco in the first Great Cataract (that of Mapura or the Atures); further on they unite together, and, rising in a chain, stretch towards the sources of the Cataniapo, the rapids of Ventuari, situated on the north of the confluence of the Asisi (lat. $5^{\circ} 10^{\prime}$ ) and the Cerro Cunevo. 7th. Five leagues south of the Atures is the chain of Quittuna, or of Maypures (lat. $15^{\circ} 13^{\prime}$ ), which forms the bar of the Second Great Cataract. None of those lofty summits are situated on the west of the Orinoco; on the east of that river rises the Cunavami, the truneated peak of Calitamini, and the Jujamari, to which Father Gili attributes an extraordinary height. 8th. The last chain of the south-west part of the Sierra Parime is separated by woody plains from the chain of Maypures; it is the chain of the Cerros de Sipapo (lat. $4^{\circ} 50^{\prime}$ ); an enormous wall, behind which the powerful chief of the Guaypunabi Indians intrenched himself during the expedition of Solano. The chain of Sipapo may be considered as the beginning of the range of lofty mountains which bound, at the distance of some leagues, the right bank of the Orinoco, where that river runs from S.E. to N.W., between the mouth of the Ventuari, the Jao, and the Padamo (lat. $\left.3^{\circ} 15^{\prime}\right)$. In ascending the Orinoco, above the cataract of Maypures, we find, long before we reach the point where it turns, near San Fernando del Atabapo, the mountains disappearing from the bed of the river, and from the mouth of the Zama there are only insulated rocks in the plains. The chain of Sipapo forms the south-west limit of the system of mountains of Parime, between $70 \frac{1}{2}^{\circ}$ and $68^{\circ}$ of longitude. Modern geologists have observed that the culminant points of a group are less frequently found at its centre than
towards one of its extremities, preceding, and announcing in some sort, a great depression* of the chain. This phenomenon is again observed in the group of the Parime, the loftiest summits of which, the Duida and the Maraguaca, are in the most southerly range of mountains, where the plains of the Cassiquiare and the Rio Negro begin.

These plains or savannahs, which are covered with forests only in the vicinity of the rivers, do not, however, exhibit the same uniform continuity as the Llanos of the Lower Orinoco, of the Meta, and of Buenos Ayres. They are interrupted by groups of hills (Cerros de Daribapa), and by insulated rocks of grotesque form which pierce the soil, and from a distance fix the attention of the traveller. These granitic, and often stratified masses, resemble the ruins of pillars or edifices. The same force which upheaved the whole group of the Sierra Parime, has acted here and there $\dot{m}$ the plains as far as beyond the equator. The existence of these steeps and sporadic hills, renders it difficult to determine the precise limits of a system in which the mountains are not longitudinally ranged as in a vein. As we advance towards the frontier of the Portuguese province of the Rio Negro the high rocks become more rare, and we no longer find the shelves or dykes of gneiss-granite which cause rapids and cataracts in the rivers.

Such is the surface of the soil between $68 \frac{1}{2}^{\circ}$ and $70 \frac{r}{2}$ of longitude, between the meridian of the bifurcation of the Orinoco, and that of San Fernando de Atabapo; further on, westward of the Upper Rio Negro, towards the source of that river, and its tributary streams the Xiè and the Uaupes (lat. $1^{\circ}-2 \frac{1}{4}^{\circ}$, long. $72^{\circ}-74^{\circ}$ ) lies a small mountainous tableland, in which Indian traditions place a Laguna de oro, that is a lake, surrounded with beds of auriferous earth. $\dagger$ At Maroa, the most westerly mission of the Rio Negro, the Indians assured me that that river, as well as the Inirida (a, tributary of the Guavare), rises at the distance of five days'

## * As seen in Mont Blanc and Chimborazo.

$\dagger$ According to the journals of Acunha and Fritz, the Manao Indians (Manoas) obtaiced from the banks of the Yquiari (Iguiare or Iguare), gold of which they made thin plates. The manuscript notes of Don Apollinario also mention the gold of the Rio Uaupes. (La Condamine, Voyage à l'Amazone.) We must not confound the Laguna de Oro, which is said
march, in a country bristled with hills and rocks. The natives of San Marcellino speak of a Sierra Tunuhy, nearly thirty leagues west of their village, between the Xie and the Icanna. La Condamine learned also from the Indians of the Amazon, that the Quiquiari comes from " a country of mountains and mines." Now, the Iquiari is placed by the French astronomer between the equator and the mouth of the Xiè (Ijié), which identifies it with the Iguiare that falls into the Icanna. We cannot advance in the geologic knowledge of America without having continually recourse to the researches of comparative geography. The small system of mountains, which we may provisionally call that of the sources of the Rio Negro and the Uaupes, and the culminant points of which are not probably more than 100 or 120 toises high, appears to extend southward to the basin of Rio Yupura, where rocky ridges form the cataracts of the Rio de los Engaños and the Salto Grande de Yupura (south lat. $0^{\circ} 40^{\prime}$ to north lat. $0^{\circ} 28^{\prime}$ ), and the basin of the Upper Guaviare towards the west. We find in the course of this river, from 60 to 70 leagues west of San Fernando del Atababo, two walls of rocks bounding the strait (nearly $3^{\circ} 10^{\prime}$ nor. lat. and $733^{30}$ long.) where father Maiella terminated his excursion. That missionary told me, that in going up the Guaviare, he perceived near the strait (angostura), a chain of mountains bounding the horizon on the south. It is not known whether those mountains traverse the Guaviare more to the west, and join the spurs which advance from the eastern Cordillera of New Grenada, between the Rio Umadea and the Rio Ariari, in the direction of the savannahs of San Juan de los Llanos. I doubt the existence of this junction. If it really existed, the plains of the Lower Orinoco would communicate with those of the Amazon only by a very narrow land-strait, on the east of the mountainous country which surrounds the source of the Rio Negro: but it is more probable that this mountainous country (a small system of mountains, geognostically dependent on the Sierra Parime) forms as it were an
to be found in going up the Uaupes (nor. lat $0^{\circ} 40^{\prime}$ ) with another gold lake (south lat. $1^{\circ} 10^{\prime}$ ) which La Condamine calls Marahi or Morachi (water), and which is merely a tract often inundated between the sources of the Jurubech (Urubaxi) and the Rio Marahi, a tributary stream of the Caqueta.
island in the Llanos of Guaviare and Yupura. Father Pugnet, Principal of the Franciscan convent at Popayan, assured me, that when he went from the missions settled on the Rio Caguan to Aramo, a village situated on the Rio Guayavero, he found only treeless savannahs, extending as far as the eye could reach. The chain of mountains placed by several modern geographers, between the Meta and the Vichada, and which appears to link the Andes of New Grenada with the Sierra Parime, is altogether imaginary.

We have now examined the prolongation of the Sierra Parime on the west, towards the source of the Rio Negro: it remains for us to follow the same group in its eastern direction. The mountains of the Upper Orinoco, eastward of the Raudal of the Guaharibos (nor. lat. $1^{\circ} 15^{\prime}$ long. $67^{\circ} 38^{\prime}$ ), join the chain of Pacaraina, which divides the waters of the Carony and the Rio Branco, and of which the micaceous schist, resplendent with silvery lustre, figures so conspicuously in Raleigh's El Dorado. The part of that chain containing the sources of the Orinoco has not yet been explored; but its prolongation more to the east, between the meridian of the military post of Guirior and the Rupunuri, a tributary of the Essequibo, is known to me through the travels of the Spaniards Antonio Santos and Nicolas Rodriguez, and also by the geodesic labours of two Portuguese, Pontes and Almeida. Two portages but little frequented* are situated between the Rio Branco and the Rio Essequibo, south of the chain of Pacaraina; they shorten the land-road leading from the Villa del Rio Negro to Dutch Guiana. On the contrary, the portage between the basin of the Rio Branco and that of the Carony, crosses the summit of the chain of Pacaraina. On the northern slope of this chain rises the Anocapra, a tributary of the Paraguamusi or Paravamusi; and on the southern slope, the Araicuque, which, with the Uraricapara, forms the famous Valley of Inundations, above the destroyed mission of Santa Rosa (lat. $3^{\circ} 46^{\prime}$, long. $65^{\circ} 10^{\prime}$ ). The principal Cordillera, which appears of little breadth, stretches on a length of 80 leagues, from the portage of Anocapra, (long. $65^{\circ} 35^{\prime}$ ) to the left bank of the Rupunuri (long. $61^{\circ} 50^{\prime}$ ), following the parallels

[^475]of $4^{\circ} 4^{\prime}$ and $4^{\circ} 12^{\prime}$. We there distinguish, from west to east the mountains of Pacaraina, Tipique, Tauyana, among which rises the Rio Parime (a tributary of the Uraricuera), Tubachi, Christaux (lat. $3^{\circ} 56^{\prime}$, long. $62^{\circ} 52^{\prime}$ ), and Canopiri. The Spanish traveller, Rodriguez, marks the eastern part of the chain by the name of Quimiropaca; but prefering to adopt general names, I continue to give the name of Pacaraina to the whole of this Cordillera, which links the mountains of the Orinoco to the interior of Dutch and French Guiana, and which Raleigh and Keymis made known in Europe at the end of the 16 th century. This chain is broken by the Rupunuri and the Essequibo, so that one of their tributary streams, the Tavaricuru, takes it rise on the southern declivity, and the other, the Sibarona, on the northern. On approaching the Essequibo, the mountains are more developed towards the south-east, and extend beyond $2 \frac{1_{2}}{}{ }^{\circ}$ north lat. From this eastern branch of the chain of Pacaraina the Rio Rupunuri rises near the Cerro Uassari. On the right bank of the Rio Branco, in a still more southern latitude (between $1^{\circ}$ and $2^{\circ}$ north) is a mountainous territory in which the Caritamini, the Padaviri, the Cababuri (Cavaburis) and the Pacimoni take their source, from east to west. This western branch of the mountains of Pacaraina separates the basin of Rio Branco from that of the Upper Orinoco, the sources of which are probably not found east of the meridian of $66^{\circ} 15^{\prime}$ : it is linked with the mountains of Unturan and Yumariquin, situated S. E. of the mission of Esmeralda. Thence it results, that, while on the west of the Cassiquiare, between that river, the Atabapo, and the Rio Negro, we find only vast plains, in which rise some little hills and insulated rocks; real spurs stretch eastward of the Cassiquiare, from N. W. to S. E. and form a continued mountainous territory as far as $2^{\circ}$ north lat. The basin only, or rather the transversal valley of the Rio Branco, forms a kind of gulf, a succession of plains and savannahs (campos) several of which penetrate from south to north, into the mountainous land between the eastern and western branches of the chain of Pacaraina, to the distance of eight leagues north of the parallel of San Joaquin.

We have just examined the southern part of the vast system of the mountains of Parime, between $2^{\circ}$ and $4^{\circ}$ of
latitude, and between the meridians of the sources of the Orinoco and the Essequibo. The development of this system of mountains northward between the chain of Pacaraina and Rio Cuyuni, and between the meridians $66^{\circ}$ and $61 \frac{30^{\circ}}{}{ }^{\circ}$ is still less known. The only road frequented by white men is that of the river Paragua, which receives the Paraguamusi, near the Guirior. We find indeed, in the journal of Nicolas Rodriguez, that he was constantly obliged to have his canoe carried by men (arrastrando) past the cataracts which intercept the navigation; but we must not forget a circumstance, of which my own experience furnished me with frequent proofs,-that the cataracts in this part of South America are often caused only by ridges of rocks which do not form mountains. Rodriguez names but two between Barceloneta and the mission of San Jose; while the missionaries place more to the east, in $6^{\circ}$ latitude, between the Rio Caroni and the Cuyuni, the Serranias of Usupama and Rinocote. The latter crosses the Mazaruni, and forms thirty-nine cataracts in the Essequibo, from the military post of Arinda (lat. $5^{\circ} 30^{\prime}$ ) to the mouth of Rupunuri.

With respect to the continuation of the system of the mountains of Parime, south-east of the meridian of the Essequibo, the materials are entirely wanting for tracing it with precision. The whole interior of Dutch, French, and Portuguese Guiana, is a terra incognita; and the astronomical geography of those countries has scarcely made any progress during the space of thirty years. If the American limits recently fixed between France and Portugal, should one day cease to be mere diplomatic illusions, and acquire reality, in being traced on the territory by means of astronomical observations, (as was projected in 1817), this undertaking would lead geographical engineers to that unknown region, which, at $3 \frac{1}{2}^{\circ}$ west of Cayenne, divides the waters between the coast of Guiana and the Amazon. Till that period, which the political state of Brazil seems to retard, the geognostic table of the group of Parime can only be completed by scattered notions collected in the Portuguese and Dutch colonies. In going from the Uassari mountains (lat. $2^{\circ} 25^{\prime}$, long. $61^{\circ} 50^{\prime}$ ) which form a part of the eastern branch of the Cordillera of Pacaraina, we find towards the east, a chain of mountains, called by
the missionaries Acaray and Tumucuraque. Those two names are found on our maps between $0 \frac{1}{2}^{\circ}$ and $3^{\prime}$ north latitude. Raleigh first made known, in 1596, the system of the mountains of Parime, between the sources of the Rio Carony and the Essequibo, by the name of Wacarima (Pacarima), and the Jesuits Acunha and Artedia furnished, in 1639, the first precise notions of that part of this system which extends from the meridian of Essequibo to that of Oyapoc. There they place the mountains of Yguaracuru and Paraguaxo, the former of which gives birth to a 'gold river,' (Rio de oro), a tributary of the Curupatuba* ; and according to the assertion of the natives, subterraneous noises are sometimes heard from the latter. The ridge of this chain of mountians, which runs in a direction S. $85^{\circ} \mathrm{E}$. from the peak of Duida, near the Esmeralda (lat. $3^{\circ} 19^{\prime}$ ), to the rapids of the Rio Manaye, near Cape Nord (lat. $1^{\circ}$ $50^{\prime}$ ), divides, in the parallel of $2^{\circ}$, the northern sources of the Essequibo, the Maroni, and the Oyapoc, from the southern sources of the Rio Trombetas, Curupatuba, and Paru. The most southern spurs of this chain approach nearer to the Amazon, at the distance of fifteen leagues. These are the first heights which we perceived after having lefi Xeberos and the mouth of the Huallaga. They are constantly seen in navigating from the mouth of the Rio Topayo towards that of Paru, from the town of Santarem to Almeirim. The peak Tripoupou is nearly in the meridian of the former of those towns, and is celebrated among the Indians of Upper Maroni. It is said that farther eastward, at Melgaço, the Serras do Velho and do Paru are still distinguished in the horizon. The real boundaries of this series of sources of the Rio Trombetas are better known southward than northward, where a mountainous

[^476]country appears to advance in Dutch and French Guiana, as far as within twenty to twenty-five leagues of the coast. The numerous cataracts of the rivers of Surinam, Maroni, and Oyapoc, prove the extent and the prolongation of rocky ridges; but in those regions nothing indicates the existence of continued plains or table-lands some hundred toises high, fitted for the cultivation of the plants of the tem. perate zone.

The system of the mountains of Parime surpasses in extent nineteen times that of the whole of Switzerland. Even considering the mountainous group of the sources of the Rio Negro and the Xiè as independent or insulated amidst the plains, we still find the Sierra Parime (between Maypures and the sources of the Oyapoc) to be 340 leagues in length; its greatest breadth (the rocks of Imataca, near the delta of the Orinoco, at the sources of the Rio Paru) is 140 leagues. In the group of the Parime, as well as in the group of the mountains of central Asia, between the Himalaya and the Altai, the partial chains are often interrupted and have no uniform parallelism. Towards the south-west, however (between the strait of Baraguan, the mouth of the Rio Zama, and the Esmeralda), the line of the mountains is generally in the direction of $\mathrm{N} .70^{\circ} \mathrm{W}$. Such is also the position of a distant coast, that of Portuguese, French, Dutch, and English Guiana, from Cape North to the mouth of the Orinoco; such is the mean direction of the course of the Rio Negro and Yupura. It is desirable to fix our attention on the angles formed by the partial chains, in different regions of America, with the meridians; because on less extended surfaces, for instance in Germany, we find also this singular co-existence of groups of neighbouring mountains following laws of direction altogether different, though every separate group exhibits the greatest uniformity in the line of chains.

The soil on which the mountains of Parime rise, is slightly convex. By barometric measures I found that between $3^{\circ}$ and $4^{\circ}$ of north latitude, the plains are elevated from 160 to 180 toises above sea-level. This height will appear considerable if we reflect that at the foot of the Andes of Peru, at Tomependa, 900 leagues from the coast of the Atlantic Ocean, the Llanos or plains of the Amazon
rise only to the height of 194 toises. The distinctive characteristics of the group of the mountains of Parime are the rocks of granite and gneiss-granite, the total absence of calcareous secondary formations, and the shelves of bare rock (the tsy of the Chinese deserts), which occupy immense spaces in the savannahs.
V. Group of the Brazil Mountains:-This group has hitherto been marked on the maps in a very erroneous way. The temperate table-lands and real chains of 300 to 500 toises high, have been confounded with countries of exceedingly hot temperature, and of which the undulating surface presents only ranges of hills variously grouped. But the observations of scientific travellers have recently thrown great light on the orography of Portuguese America. The mountainous region of Brazil, of which the mean height rises at least to 400 toises, is comprehended within very narrow limits, nearly between $18^{\circ}$ and $28^{\circ}$ south latitude; it does not appear to extend, between the provinces of Goyaz and Matogrosso, beyond long. $53^{\circ}$ west of the meridian of Paris.

When we regard in one view the eastern configuration of North and South America, we perceive that the coast of Brazil and Guiana, from Cape Saint Roque to the mouth of the Orinoco (stretching from S.E. to N.W.), corresponds with that of Labrador, as the coast from Cape Saint Roque to the Rio de la Plata corresponds with that of the United States (stretching from S.W.toN.E.). The chain of the Alleghanies is opposite to the latter coast, as the principal Cordilleras of Brazil are nearly parallel to the shore of the provinces of Porto Seguro, Rio Janeiro, and Rio Grande. The Alleghanies, generally composed of grauwacke and transition rocks, are somewhat loftier than the almost primitive mountains (of granite, gneiss, and mica-slate), of the Brazilian group; they are also of a far more simple structure, their chains lying nearer to each other, and preserving, as in the Jura, a more uniform parallelism.

If, instead of comparing those parts of the new continent situated north and south of the equator, we confine ourselves to South America, we find on the western and northern coasts
in their whole length, a continued chain near the shore (the Andes and the Cordillera of Venezuela), while the eastern coast presents masses of more or less iofty mountains only between the $12^{\circ}$ and $30^{\circ}$ south lat. In this space, 360 leagues in length, the system of the Brazil mountains corresponds geologically in form and position with the Andes of Chile and Peru. Its most considerable portion lies between the parallels $15^{\circ}$ and $22^{\circ}$, opposite the Andes of Potosi and La Paz, but its mean height is five toises less, and cannot even be compared with that of the mountains of Parime, Jura, and Auvergne. The principal direction of the Brazilian chains, where they attain the height of from four to five hundred toises, is from south to north, and from south-south-west to north-north-east; but, between $13^{\circ}$ and $19^{\circ}$ the chains are considerably enlarged, and at the same time lowered towards the west. Ridges and ranges of hills seem to advance beyond the land-straits which separate the sources of the Rio Araguay, Parana, Topayos, Paraguay, Guapore, and Aguapehy, in $63^{\circ}$ long. As the western widening of the Brazilian group, or rather the undulations of the soil in the Campos Parecis, correspond with the spurs of Santa Cruz de la Sierra, and Beni, which the Andes send out eastward, it was formerly concluded that the system of the mountains of Brazil was linked with that of the Andes of Upper Peru. I myself laboured under this error in my first geologic studies.

A coast chain (Serra do Mar) runs nearly parallel with the coast, north-east of Rio Janeiro, lowering considerably towards Rio Doce, and losing itself almost entirely near Bahia (lat. $12^{\circ} \cdot 58^{\prime}$ ). According to M. Eschwege,* some small ridges reach Cape Saint Roque (lat. $5^{\circ} 12^{\prime}$ ). Southeast of Rio Janeiro, the Serra do Mar follows the coast behind the island of Saint Catherine as far as Torres (lat. $29^{\circ} 20^{\prime}$ ) ; it there turns westward, and forms an elbow stretching by the Campos of Vacaria, towards the banks of the Jacuy.

Another chain is situated wostward of the shore-chain of Brazil. This is the most lofty and considerable of all, and is called the chain of Villarica. Mr. Eschwege distinguishes

* Geognostiches Gemälde von Brasilien, 1822. The limestone of Bahia abounds in fossil wood.
it by the name of Serra do Espinhaço; and considers it as the principal part of the whole structure of the mountains of Brazil. This Cordillera loses itself northward,* between Minas Novas and the southern extremity of the Capitania of Bahia, in $16^{\circ}$ lat. It is there more than 60 leagues removed from the coast of Porto Seguro; but southward, between the parallels of Rio Janeiro and Saint Paul (lat. $22^{\circ}-23^{\circ}$ ), in the knot of the mountains of Serra da Mantiquiera, it draws so near to the Cordillera of the shore (Serra do Mar), that they are almost confounded together. In the same manner, the Serra do Espinhaço follows constantly the direction of a meridian, towards the north; while towards the south it runs south-east, and terminates about $25^{\circ}$ lat. The chain reaches its highest elevation between $18^{\circ}$ and $21^{\circ}$; and there the spurs and table-lands at its back are of sufficient extent to furnish lands for cultivation, where, at successive heights, there are temperate climates comparable to the delicious climates of Xalapa, Guaduas, Caracas, and Caripe. This advantage, which depends at once on the widening of the mass of the chain, and of its spurs, is nowhere found in the same degree east of the Andes, not even in chains of more considerable absolute height, as those of Venezuela and the Orinoco. The culminant points of the Serra do Espinhaço, in the Capitania of Minas Geraes, are the Itambe ( 932 toises), the Serra da Piedade, near Sabara ( 910 toises), the Itacolumi, properly Itacunumi ( 900 toises), the Pico of Itabira ( 816 toises), the Serras of Caraça, Ibitipoca, and Papagayo. Saint Hilaire felt piercing cold in the month of November (therefore in summer) in the whole Cordillera of Lapa, from the Villa do Principe to the Morro de Gaspar Suares.

We have just noticed two chains of mountains nearly parallel, but of which the most extensive (the littoral chain) is the least lofty. The capital of Brazil is situated at the point where the two chains draw nearest together and are linked together on the east of the Serra de Mantiqueira, if

[^477]not by a transversal ridge, at least by a mountainous territory. Old systematic ideas respecting the rising of mountains in proportion' as we advance into a country, would have warranted the belief that there existed, in the Capitania of Mato Grosso, a central Cordillera much loftier than that of Villarica or do Espinhaço; but we now know (and this is confirmed by climateric circumstances) that there exists no continued chain, properly speaking, westward of Rio San Francisco, on the frontiers of Minas Geraes and Goyaz. We find only a group of mountains, of which the culminant points are the Serras da Canastra (south-west of Paracatu) and da Marcella (lat. $18 \frac{1}{2}^{\circ}$ and $19 \cdot 10^{\circ}$ ), and, further north, the Pyrenees stretching from east to west (lat. $16^{\circ} 10^{\prime}$ ) between Villaboa and Mejaponte). M. Eschwege has named the group of mountains of Goyaz the Serra dos Vertentes, because it divides the waters between the southern tributary streams of the Rio Grande or Parana, and the northern tributary streams of Rio Tucantines. It runs southward beyond the Rio Grande (Parana), and approaches the chain of Espinpapo in $23^{\circ}$ latitude, by the Serra do Franca. It attains only the height of 300 or 400 toises, with the exception of some summits N.W. of Paracatu, and is consequently much lower than the chain of Villarica.

Further on, west of the meridian of Villaboa, there are only ridges and a series of low hills which, on a length of $12^{\circ}$, form the "division of water" (lat. $13^{\circ}-17^{\circ}$ ), between the Araguay and the Paranaiba (a tributary of the Parana), between the Rio Topayos and the Paraguay, between the Guapore and the Aguapehy. The Serra of San Marta is (long. $15 \frac{1}{2}^{\circ}$ ) is somewhat lofty, but maps have vastly exaggerated the height of the Serras or Campos Parecis north of the towns of Cuyaba and Villabella (lat. $13^{\circ}-14^{\circ}$, long. $58^{\circ}-62^{\circ}$ ). These Campos, which take their name from that of a tribe of wild Indians, are vast, barren table-lands, entirely destitute of vegetation; and in them the sources of the tributary streams of three great rivers, the Topayos, the Madeira, and the Paraguay, take their rise.

According to the measures and geologic observations of M. Eschwege, the high summits of the Serra do Mar (the coast-chain) scarcely attain 660 toises; those of the Serra do Espinhaço (chain of Villarica), 950 toises ; those of Serra
de los Vertentes (group of Canastra and the Brazilian Pyrenees), 450 toises. Further west, the surface of the soil seems to present but slight undulations; but no measure of height has been made beyond the meridian of Villaboa. Considering the system of the mountains of Brazil in their real limits, we find, except some conglomerates, the same absence of secondary formations as in the system of the mountains of the Orinoco (group of Parime). These secondary formations, which rise to considerable heights in the Cordillera of Venezuela and Cumana, belong only to the low regions of Brazil.

## B. Plains (Llanos) or Basins.

In that part of South America situated on the east of the Andes, we have successively examined three systems of mountains, those of the shore of Venezuela, of the Parime, and Brazil: we have seen that this mountainous region, which equals the Cordillera of the Andes, not in mass, but in area and horizontal section of surface, is three times less elevated, much less rich in precious metals adhering to the rock, destitute of recent traces of volcanic fire, and, with the exception of the coast of Venezuela, little exposed to the violence of earthquakes. The average height of the three systems diminishes from north to south, from 750 to 400 toises; those of the culminant points (maxima of the height of each group) from 1350 to 1000 or 900 toises. Hence it results that the loftiest chain, with the exception of the small insulated system of the Sierra Nevada of Santa Marta, is the Cordillera of the shore of Venezuela, which is itself but a continuation of the Andes. Directing our attention northward, we find in Central America (lat. $12^{\circ}-30^{\circ}$ ), and North America (lat. $30^{\circ}-70^{\circ}$ ), on the east of the Andes of Guatimala, Mexico, and Upper Louisiana, the same regular lowering which struck us towards the south. In this vast extent of land, from the Cordillera of Venezuela to the polar circle, eastern America presents two distinct systems, the group of the mountains of the West Indies (which in its eastern part is volcanic) and the chain of the Alleghanies. The former of these systems, partly covered by the ocean, may be compared, with respect to its relative position and
form, to the Sierra Parime; the latter, to the Brazil chains, running also from S.W. to N.E. The culminant points of those two systems rise to 1138 and 1040 toises. Such are the elements of this curve, of which the convex summit is in the littoral chain of Venezuela :

AMERICA, EAST OF THE ANDES.

| gystems of mountains. | maxima of heights. |
| :---: | :---: |
| Brazil Group ............................. | Itacolumi....................... 900 t . (south lat. $20 \frac{1}{2}^{\circ}$ ). |
| Parime Group............................ | Duida .......................... 1300 (north lat. $3 \frac{1}{4}^{\circ}$ ). |
| Littoral Chain of Venezuela ........ | Silla of Caracas. $\qquad$ 1350 (north lat. $10 \frac{1}{2}{ }^{\circ}$ ). |
| Group of the West Indies ........... | $\begin{aligned} & \text { Blue Mountains ........... } 1138 \\ & \text { (north lat. } 18 \frac{1}{6}^{\circ} \text { ). } \end{aligned}$ |
| Chain of the Alleghanies............... | Mount Washington $\qquad$ 1040 (north lat. $444^{\circ}$ ). |

I have preferred indicating in this table the culminant points of each system, to the mean height of the line of elevation; the culminant points are the results of direct measures, while the mean height is an abstract idea somewhat vague, particularly when there is only one group of mountains, as in Brazil, Parime, and the West Indies, and not a continued chain. Although it cannot be doubted that, among the five systems of mountains on the east of the Andes, of which one only belongs to the southern hemisphere, the littoral chain of Venezuela is the most elevated (having a culminant point of 1350 toises, and a mean height from the line of elevation of 750), we yet recoguise with surprise, that the mountains of eastern America (whether continental or insular) differ very inconsiderably in their height above the level of the sea. The
five groups are all nearly of an average height of from 500 to 700 toises; and the culminant points (maxima of the lines of elevation) from 1000 to 1300 toises. That uniformity of structure, in an extent twice as great as Europe, appears to me a very remarkable phenomenon. No summit east of the Andes of Peru, Mexico, and Upper Louisiana, rises beyond the limit of perpetual snow.* It may be added, that with the exception of the Alleghanies, no snow falls sporadically in any of the eastern systems which we have just examined. From these considerations it results, and above all, from the comparison of the New Continent with those parts of the old world which we know best, with Europe and Asia, that America, thrown into the aquatic hemispheret of our planet, is still more remarkable for the continuity and extent of the depressions of its surface, than for the height and continuity of its longitudinal ridge. Beyond and within the isthmus of Panama, but eastward of the Cordillera of the Andes, the mountains scarcely attain, over an extent of 600,000 square leagues, the height of the Scandinavian Alps, the Carpathians, the Monts-Dorés (in Auvergne), and the Jura. One system only, that of the

[^478]Andes, comprises in America, over a long and narrow zone of 3000 leagues, all the summits exceeding 1400 toises high. In Europe, on the contrary, even considering the Alps and the Prrenees as one sole line of elevation, we still find summits far from this line or principal ridge, in the Sierra Nevada of Grenada, Sicily, Greece, the Apennines, perhaps also in Portugal, from 1500 to 1800 toises high.* The contrast between America and Europe, with respect to distribution of the culminant points, which attain from 1300 to 1500 toises, is the more striking, as the low eastern mountains of South America, of which the maximum of elevation is only from 1300 to 1400 toises, are situated beside a Cordillera of which the mean height exceeds 1800 toises, while the secondary system of the mountains of Europe rises to maxima of elevation of 1500 to 1800 toises, near a principal chain of at least 1200 toises of average height.

## maxima of the line of elevation in the same PARALLELS.

Andes of Chile, Upper Peru. Knots of the mountains of Porco and Cuzco, 2500 toises.
Andes of Popayan and Cundinamarca. Chan of Guacas, Quindiu, and Antioquia. More than 2800 toises.
Insulated group of the Snowy Mountains of Santa Marta. It is believed to be 3000 toises high.
Volcanic Andes of Guatimala, and primitive Andes of Oaxaca, from 1700 to 1800 toises.
Andes of New Mexico and Upper Louisiana (Rocky Mountains) and forther west. The Maritime Alps of New Albion, 1600 to 1900 toises.

Group of the Brazil Mountains; a little lower than the Cevennes; 900 to 1000 toises.
Group of Parime Mountains; little lower than the Carpathians; 1300 toises.
LittoralChain of Venceuela; 80 toises lower than the Scandinavian Alps; 1350 toises.
Group of the West Indies; 170 toises higher than the mountains of Auvergne, 1140 toises.
Chain of the Alleghanies; 160 toises higher than the chains of Jura and the Gates of Malabar; 1040 toises.

[^479]This table contains the whole system of mountains of the New Continent; namely: the Andes, the maritime Alps of California or New Albion, and the five groups of the east.

I may subjoin to the facts I have just stated, an observation equally striking; in Europe, the maxima of secondary systems, which exceed 1500 toises, are found solely on the south of the Alps and Pyrenees, that is, on the south of the principal continental ridge. They are situated on the side where that ridge approaches nearest the shore, and where the Mediterranean has not overwhelmed the land. On the north of the Alps and Pyrenees, on the contrary, the most elevated secondary systems, the Carpathian and the Scandinavian mountains " do not attain the height of 1300 toises. The depression of the line of elevation of the second order is consequently found in Europe as well as in America, where the principal ridge is farthest removed from the shore. If wo did not fear to subject great phenomena to too small a scale, we might compare the difference of the height of the Alps and the mountains of eastern America, with the difference of height observable between the Alps or the Pyrenees, and the Monts Dorés, the Jura, the Vosges, or the Black Forest.

We have just seen that the causes which upheaved the oxidated crust of the globe in ridges, or in groups of mountains, have not acted very powerfully in the vast extent of country stretching from the eastern part of the Andes, towards the Old World; that depression and that continuity of plains are geologic facts, the more remarkable, as they extend nowhere else in other latitudes. The five mountain systems of eastern America, of which we have stated the limits, divide that part of the continent into an equal number of basins, of which, only that of the Caribbean Sea remains submerged. From north to south, from the polar circle to the Straits of Magellan, we see in succession:

[^480]I.-The basin of the Mississippi and of Carada. An able geologist, Mr. Edwin James, has recently shewn that this basin is comprebended between the Andes of New Mexico, or Upper Louisiana, and the chains of the Alleghanies which stretch northward in crossing the rapids of Quebec. It being quite as open northward as southward, it may be designated by the collective name of the basin of the Mississippi, the Missouri, the river St. Lawrence, the great lakes of Canada, the Mackenzie river, the Saskatchawan, and the coast of Hudson's Bay. The tributary streams of the lakes and those of the Mississippi are not separated by a chain of mountains running from east to west, as traced on several maps; the line of partition of the waters is marked by a slight ridge, a rising of two counter-slopes in the plain. There is no chain between the sources of the Missouri and the Assineboine, which is a branch of the Red River and of Hudson's Bay. The surface of these plains, almost all savannah, between the polar sea and the gulf of Mexico, is more than 270,000 square sea leagues, nearly equal to the area of the whole of Europe. On the north of the parallel of $42^{\circ}$, the general slope of the land runs eastward; on the south of that parallel, it inclines southward. To form a precise idea how little abrupt are these slopes we must recollect that the level of Lake Superior is 100 toises; that of Lake Erie, 88 toises, and that of Lake Ontario, 36 toises above the level of the sea. The plains around Cincinnati (lat. $39^{\circ} 6^{\prime}$ ), are scarcely, according to Mr . Drake, 80 toises of absolute height. Towards the west, between the Ozark mountains and the foot of the Andes of Upper Louisiana (Rocky Mountains, lat. $35^{\circ}-38^{\circ}$ ), the basin of the Mississippi is considerably elevated in the vast desert described by Mr. Nuttal. It presents a series of small table-lands, gradually rising one above another, and of which the most westerly (that nearest the Rocky Mountains, between the Arkansas and the Padouca), is more than 450 toises high. Major Long measured a base to determine the position and height of James Peak. In the great basin of the Mississippi, the line that separates the forests and the savannahs runs, not, as may be supposed, in the manner of a parallel, but like the Atlantic coast, and the Alleghany mountains themselves, from N.E. to S.W., from Pittsburg towards Saint Louis, and 2 A 2
the Red River of Nachitoches, so that the northern part only of the state of Illinois is covered with gramina. This line of demarcation is not only interesting for the geography of plants, but exerts, as we have said above, great influence in retarding culture and population north-west of the Lower Mississippi. In the United States, the prairie countries are more slowly colonized; and even the tribes of independent Indians are forced by the rigour of the climate to pass the winter on the banks of rivers, where poplars and willorss are found. The basins of the Mississippi, of the lakes of Canada and the St. Lawrence, are the largest in America; and though the total population does not rise at present beyond three millions, it may be considered as that in which, between latitude $29^{\circ}$ and $45^{\circ}$ (long. $74^{\circ}-94^{\circ}$ ), civilization has made the greatest progress. It may even be said that in the other basins (of the Orinoco, the Amazon, and Buenos Ayres), agricultural life scarcely exists; it begins, on a small number of points only, to supersede pastoral life, and that of fishing and hunting nations. The plains between the Alleghanies and the Andes of Upper Louisiana are of such vast extent, that like the Pampas of Choco and Buenos Ayres, bamboos (Ludolfia miega) and palm-trees grow at one extremity, while the other, during a great part of the year, is covered with ice and snow.
II.-The basin of the Gulf of Mexico, and of the Caribbean Sea. This is a continuation of the basin of the Mississippi, Louisiana, and Hudson's Bay. It may be said, that all the low lands on the coast of Venezuela situated north of the littoral chain, and of the Sierra Nevada de Merida, belong to the submerged part of this basin. If I treat here separately of the basin of the Caribbean Sea, it is to avoid confounding what, in the present state of the globe, is partly above and partly below the ocean. The recent coincidence of the periods of earthquakes observed at Caracas, and on the banks of the Mississippi, the Arkansas, and the Ohio, justifies the geologic theories which regard as one basin the plains bounded on the south, by the littoral Cordillera of Venezuela; on the east, hy the Alleghanies and the series of the volcanos of the West Indies; and on the west, by the Ronky Mountains (Mexican Andes) and by the
series of the volcanos of Guatimala. The basin of the West Indies forms, as we have already observed, a Mediterranean with several issues, the influence of which on the political destinies of the New Continent depends at once on its central position and the great fertility of its islands. The outlets of the basin, of which the four largest * are 75 miles broad, are all on the eastern side, open towards Europe, and agitated by the current of the tropics. In the same manner as we recognize, in our Mediterranean, the vestiges of three ancient basins by the prosimity of Rhodes, Scarpanto, Candia, and Cerigo, as well as by that of Cape Sorello of Sicily, the island of Pantelaria and Cape Bon, in Africa; so the basin of the West India Islands, which exceeds the Mediterranean in extent, seems to present the remains of ancient dykes which join $\dagger$ Cape Catoche of Yucatan to Cape San Atonio of the island of Cuba; and that island to Cape Tiburon of St. Domingo ; Jamaica, the Bank of La Vibora, and the rock of Serranilla to Cape Gracias à Dios on the Mosquito Shore. From this situation of the most prominent islands and capes of the continent, there results a division into three partial basins. The most northerly has long been distinguished by a particular denomination, that of the Gulf of Mexico; the intermediary or central basin may be called the Sea of Honduras, on account of the gulf of that name which makes a part of it; and the southern basin, comprehended between the Caribbean Islands and the coast of Venezuela, the isthmus of Panama, and the country of the Mosquito Indians, would form the Caribbean Sea. The modern volcanic rocks distributed on the two opposite banks of the basin of the West Indies on the east and west, but not on the north and south, is also a phenomenon worthy of attention. In the Caribbean Islands, a group of volcanos, partly extinct and partly burning, stretches from $12^{\circ}$ to $18^{\circ}$; and in the Cordilleras of Guatimala, and Mexico from lat. $9^{\circ}$ to

[^481]191 $\frac{1}{3}^{\circ}$. I noticed on the north-west extremity of the basin of the West Indies, that the secondary formations dip towards S.E. ; along the coast of Venezuela, rocks of gneiss and primitive mica-slate dip to north-west. The basalts, amygdaloids, and trachytes, which are often surmounted by tertiary limestones, appear only towards the eastern and western banks.
III.-The basin of the Lower Orinoco, or ther Platns of Venezumla.-This basin, like the plains of Lombardy, is open to the east. Its limits are the littoral chain of Venezuela on the north, the eastern Cordillera of New Grenada on the west, and the Sierra Parime on the south; but as the latter group extends on the west only to the meridian of the cataracts of Maypures (long. $70^{\circ} 37^{\prime}$ ), there remains an opening or land-strait, running from north to south, by which the Llanos of Venezuela communicate with the basin of the Amazon and the Rio Negro. We must distinguish between the basin of the Lower Orinoco, properly so called (north of that river and the Rio Apure), and the plains of Meta and Guaviare. The latter occupy the space between the mountains of Parime and New Grenada. The two parts of this basin have an opposite direction; but being alike covered with gramina, they are usually comprehended in the country under the same denomination. Those Llanos extend, in the form of an arch, from the mouth of the Orinoco, by San Feruando de Apure, to the confluence of the Rio Caguan with the Jupura, consequently along a length of more than 360 leagues.
(a) Part of the basin of Venezuela running from east to west.-The general slope is eastward, and the mean height from 40 to 50 toises. The western bank of that great sea of verdure (mar de yerbas) is formed by a group of mountains, several of which equal or exceed in height the Peak of Teneriffe and Mont Blanc. Of this number are the Paramos del Almorzadero, Cacota, Laura, Porquera, Mucuchies, Timotes, and Las Rosas. The height of the northern and southern banks is generally less than 500 or 600 toises. It is somewhat extraordinary that the maximum of the depression of the basin is not in its centre, but on its southern limit, at the Sierra Parime. It is only between the meridians
of Cape Codera and Cumana, where a great part of the littoral Cordillera of Venezuela has been destroyed, that the waters of the Llanos (the Rio Unare and the Rio Neveri) reach the northern coast. The partition ridge of this basin is formed by small table-lands, known by the names of Mess de Amana, Guanipa, and Jonoro. In the eastern part, between the meridians $63^{\circ}$ and $66^{\circ}$, the plains or savannahs run southward beyond the bed of the Orinoco and the Imataca, and form (as they approach the Cujuni and the Essequibo) a kind of gulf along the Sierra Pacaraina.
(b) Part of the basin of Venezuela running from south to north. -The great breadth of this zone of savannahs (from 100 to 120 leagues) renders the denomination of 'landstrait' somewhat improper, at least if it be not geognostically applied to every communication of basins bounded by high Cordilleras. Perhaps this denomination more properly belongs to that part in which is situated the group of almost unknown mountains that surround the sources of the Rio Negro. In the basin comprehended between the eastern declivity of the Andes of New Grenada, and the western part of the Sierra Parime, the savannahs, as we have observed above, stretch far beyond the equator; but their extent does not determine the southern limits of the basin here under consideration. These limits are marked by a ridge which divides the waters between the Orinoco and the Rio Negro, a tributary stream of the Amazon. The rising of a counterslope almost imperceptible to the eye, forms a ridge that seems to join the eastern Cordillera of the Andes to the group of the Parime. This ridge runs from Ceja (lat. $1^{\circ} 45^{\prime}$ ), or the eastern slope of the Andes of Timana, between the sources of the Guayavero and the Rio Caguan, towards the isthmus that separates the Tuamini from Pimichin. In the Llanos, consequently, it follows the parallels of $20^{\circ} 30^{\prime}$ and $2^{\circ} 45^{\prime}$. It is remarkable that we find the divortia aquarum further westward on the back of the Andes, in the knot of mountains containing the sources of the Magdalena, at a height of 900 toises above the level of the Llanos, between the Caribbean Sea and the Pacific ocean, and almost in the same latitude ( $1^{\circ} 45^{\prime}-2^{\circ} 20^{\prime}$ ). From the isthmus of Javita towards the east, the line of the partition
of waters is formed by the mountains of the Parime group ; it first rises a little on the north-east towards the sources of the Orinoco (lat. $3^{\circ} 45^{\prime}$ ?) and the chain of Pacaraina (lat. $4^{\circ} 4^{\prime}-4^{\circ} 12^{\prime}$ ); then, during a course of 80 leagues, between the portage of the Anocapra and the banks of the Rupunuri, it runs very regularly from west to east; and finally, beyond the meridian $61^{\circ} 50^{\prime}$, it again deviates towards lower latitudes, passing between the northern sources of the Rio Suriname, the Maroni, the Oyapoc, and the southern sources of Rio Trombetas, Curupatuba, and Paru (lat. $2^{\circ}-1^{\circ} 50^{\prime}$ ). These facts suffice to prove that this first line of partition of the waters of South America (that of the northern hemisphere) traverses the whole continent between the parallels of $2^{\circ}$ and $4^{\circ}$. The Cassiquiare alone has cut its way across the ridge just described. The hydraulic system of the Orinoco displays the singular phenomenon of a bifurcation where the linit of two basins (those of the Orinoco and the Rio Negro) crosses the bed of the principal recipient. In that part of the basin of the Orinoco which runs in the direction of from south to north, as well as in that running from west to east, the maxima of depression are found at the foot of the Sierra Parime, we may even say, on its outline.
IV.-The basti of the Rio Negro and the Amazon. This is the central and largest basin of South America. It is exposed to frequent equatorial rains, and the hot and humid climate developes a force of vegetation to which nothing in the two continents can be compared. The central basin, bounded on the north by the Parime group, and on the south by the mountains of Brazil, is entirely covered by thick forests, while the two basins at the extremities of the continent (the Llanos of Venezuela and the Lower Orinoco, and the Pampas of Buenos Ayres or the Rio de la Plata) are sarannahs or prairies, plains without trees and covered with gramina. This symmetric distribution of savannahs bounded by impenetrable forests, must be connected with physical revolutions which have operated simultaneously over great surfaces.
(a.)--Part of the basin of the Amazon, running from east to west, between $2^{\circ}$ north and $12^{\circ}$ south; 880 leagues in length.

Original from

The western shore of this basin is formed by the chain of the Andes, from the knot of the mountains of Huanuco to the sources of the Magdalena. It is enlarged by the spurs of the the Rio Beni,* rich in gem-salt, and composed of several ranges of hills (lat. $8^{\circ} 11^{\prime}$ south) which advance into the plains on the eastern bank of the Paro. These hills are transformed on our maps into Upper Cordilleras and Andes of Cuchao. Towards the north, the basin of the Amazon, of which the area ( 244,000 square leagues) is only one-sixth less than the area of all Europe, rises in a gentle slope towards the Sierra Parime. At 68 of west longitude the elevated part of this Sierra terminates at $3 \frac{1}{2}^{\circ}$ north latitude. The group of little mountains surrounding the source of the Rio Negro, the Inirida and the Xiè (lat. $2^{\circ}$ ) the scattered rocks between the Atabapo and the Cassiquiare, appear like groups of islands and rocks in the middle of the plain. Some of those rocks are covered with signs or symbolical sculpture. Nations, very different from those who now inhabit the banks of the Cassiquiare, penetrated into the savannahs; and the zone of painted rocks, extending more than 150 leagues in breadth, bears traces of ancient civilization. On the east of the sporadic groups of rocks (between the meridian of the bifurcation of Orinoco and that of the confluence of the Essequibo with the Rupunuri), the lofty mountains of the Parime commence only in $3^{\circ}$ north latitude; where the plains of the Amazon terminate.

The limits of the plains of the Amazon are still less known towards the south than towards the north. The mountains that exceed 400 toises of absolute height do not appear to extend in Brazil northward of the parallels $14^{\circ}$ or $15^{\circ}$ of south latitude, and west of the meridian of $52^{\circ}$; but it is not known how far the mountainous country extends, if we may call by that name a territory bristled with hills of one hundred or two hundred toises high. Between the Rio dos

- The real name of this great river, respecting the course of which geographers have been so long divided, is Uchaparu, probably "water (para) of Ucha'; Peni also signifies 'river' or 'water;' for the language of the Maypures has very many analogies with that of the Moxos; and veni (oueni) signifies 'water' in Maypure, as una in Moxo. Perhaps the river retained the name of Maypure, ufter the Indians who spoke that language had emigrated northward in the direction of the banks of the Orinoco.

Vertentes and the Rio de Tres Barras (tributary streams of the Araguay and the Topayos), several ridges of the Monts Parecis run northward. On the right bank of the Topayos, a series of little hills advance as far as the parallel of $5^{\circ}$ south latitude, to the fall (cachoeira) of Maracana; while further west, in the Rio Madeira, the course of which is nearly parallel with that of the Topayos, the rapids and cataracts indicate no rocky ridges beyond the parallel of $8^{\circ}$. The principal depression of the basin of which we have jast examined the outline, is not near one of its banks, as in the basin of the Lower Orinoco, but at the centre, where the great recipient of the Amazon forms a longitudinal furrow inclining from west to east, under an angle of at least $\mathbf{2 5 "}^{\prime \prime}$ The barometric measurements which I made at Javita on the banks of the Tuamini, at Vasivia on the banks of the Cassiquiare, and at the cataract of Rentema, in the Upper Marañon, seem to prove that the rising of the Llanos of the Amazon northward (at the foot of the Sierra Parime), is 150 toises, and westward (at the foot of the Cordillera of the Andes of Loxa), 190 toises above the sea-level.
(b.) Part of the basin of the Amazon stretching from south to north. This is the zone or land-strait by which, between $12^{\circ}$ and $20^{\circ}$ of south latitude, the plains of the Amazon communicate with the Pampas of Buenos Ayres. The western bank of this zone is formed by the Andes, between the knot of Porco and Potosi, and that of Huanuco and Pasco. Part of the spurs of the Rio Beni, which is but a widening of the Cordilleras of Apolobamba and Cuzco and the whole promontory of Cochabamba, advance eastward into the plains of the Amazon. The prolongation of this promontory has given rise to the idea that the Andes are linked with a series of hills which the Serras dos Parecis, the Serra Melgueira, and the supposed Cordillera of San Fernando, throw out towards the west. This almost unknown part of the frontiers of Brazil and Upper Peru merits the attention of travellers. It is understood that the ancient mission of San Jose de Chiquitos (nearly lat. $17^{\circ}$; long. $67^{\circ} 10^{\prime}$, supposing Santa Crus de la Sierra, in lat. $17^{\circ} 25^{\prime}$; long. $66^{\circ} 47^{\prime}$ ), is situated in the plains, and that the mountains of the spur of Cochabamba terminate between the Guapaix (Rio de Mizque) and the

Parapiti, which lower down takes the names of Rio San Miguel and Rio Sara. The savannahs of the province of Chiquitos communicate on the north with those of Mozos, aud on the south with those of Chaco; but a ridge or line of partition of the waters is formed by the intersection of two gently sloping plains. This ridge takes its origin on the north of La Plata (Chuquisaca) between the sources of the Guapaix and the Cachimayo, and it ascends from the parallel of $20^{\circ}$ to that of $15 \frac{1}{2}^{\circ}$ south latitude, consequently on the north-east, towards the isthmus of Villabella. From this point, one of the most important of the whole hydrography of America, we may follow the line of the partition of the water to the Cordillera of the shore (Serra do Mar). It is seen winding (iat. $17^{\circ}-20^{\circ}$ ) between the northern sources of the Araguay, the Maranhão or Tocantines, the Rio San Francisco, and the southern sources of the Parana. This second line of partition which enters the group of the Brazil mountains, on the frontier of Capitania of Goyaz, separates the flowings of the basin of the Amazon from those of the Rio de la Plata, and corresponds, south of the equator, with the line we have indicated in the northern hemisphere (lat. $2^{\circ}-4^{\circ}$ ), on the limits of the basins of the Amazon and the Lower Orinoco.

If the plains of the Amazon (taking that denomination in the geognostic sense we have given it) are in general distinguished from the Llanos of Venezuela and the Pampas of Buenos Ayres, by the extent and thickness of their forests, we are the more struck by the continuity of the savannahs in that part running from south to north. It would seem as though this sea of verdure stretched forth an arm from the basin of Buenos Ayres, by the Llanos of Tucuman, Manso, Chuco, the Chiquitos, and the Moxos, to the Pampas del Sacramento, and the savannahs of Napo, Guaviare, Meta, and Apure. This arm crosses, between $7^{\circ}$ and $3^{\circ}$ south latitude, the basin of the forests of the Amazon; and the absence of trees on so great an extent of territory, together with the preponderance which the small monocotyledonous plants have acquired, is a phenomenon of the geography of plants which belongs perhaps to the action of ancient pelagic currents, or other partial revolutions of our planet.
V.-Plains of the Rio de la Plata, and of PataGONIA, from the south-western slope of the group of the Brazil mountains, to the strait of Magellan; from $20^{\circ}$ to $53^{\circ}$ of latitude. These plains correspond with those of the Mississippi and of Canada in the northern hemisphere. - If one of their extremities approaches less nearly to the polar regions, the other enters much further into the region of palm-trees. That part of this vast basin extending from the eastern coast towards the Rio Paraguay, does not present a surface so perfectly smooth as the part situated on the west and the south-east of the Rio de la Plata, and which has been known for ages by the name of Pampas, derived from the Peruvian or Quichua language.* Geognostically speaking, these two regions of east and west form only one basin, bounded on the east by the Sierra de Villarica or do Espinhaço, which loses itself in the Capitania of San Paul, near the parallel of $24^{\circ}$; issuing on the north-east by little hills, from the Serra da Canastra and the Campos Parecis towards the province of Paraguay ; on the west, by the Andes of Upper Peru and Chile; and on the north-west, by the ridge of the partition of the waters which runs from the spur of Santa Cruz de la Sierra, across the plains of the Chiquitos, towards the Serras of Albuquerque (lat. $19^{\circ} \mathbf{2}^{\prime}$ ) and San Fernando. That part only of this basin lying on the west of the Rio Paraguay, and which is entirely covered with gramina, is 70,000 square leagues. This surface of the Pampas or Llanos of Manse, Tucuman, Buenos Ayres, and eastern Patagonia, is consequently four times greater than the surface of the whole of France. The Andes of Chile narrow the Pampas by the two spurs of Salta and Cordova; the latter promontory forms so projecting a point, that there remains (lat. $31^{\circ}-32^{\circ}$ ) a plain only 45 leagues broad between the eastern extremity of the Sierra de Cordova and the right bank of the river Paraguay, stretching in the direction of a meridian, from the town of Nueva Coimbra to Rosario, below Santa Fè. Far beyond the southern frontiers of the old viceroyalty of Buenos Ayres, between the Rio Colorado and the

[^482]Rio Negro (lat. $38^{\circ}-39^{\circ}$ ) groups of mountains seem to rise in the form of islands, in the middle of a muriatiferous plain. A tribe of Indians of the south (Tehuellet), have there long borne the characteristic name of "men of the mountains" (Callilehet) or Serranos. From the parallel of the mouth of the Rio Negro to that of Cabo Blanco (lat. $41^{\circ}-47^{\circ}$ ), scattered mountains on the eastern Patagonian coast denote more considerable inequalities inland. All that part, however, of the Straits of Magellan, from the Virgins' Cape to the North Cape, on the breadth of more than 30 leagues, is surrounded by savannahs or Pampas; and the Andes of western Patagonia only begin to rise near the latter cape, exercising a marked influence on the direction of that part of the strait nearest the Pacific, proceeding from S.E. to N.W.

If we have given the plains or great basins of South America the names of the rivers that flow in their longitudinal furrows, we have not meant by so doing to compare them to mere valleys. In the plains of the Lower Orinoco and the Amazon, all the lines of the declivity doubtless reach a principal recipient, and the tributaries of tributary streams, that is the basins of different orders, penetrate far into the group of the mountains. The upper parts or high valleys of the tributary streams must be considered in a geological table, as belonging to the mountainous region of the country, and beyond the plains of the Lower Orinoco and the Amazon. The riews of the geologist are not identical with those of the hydrographer. In the basin of the Rio de la Plata and Patagonia, the waters that follow the lines of the greatest declivities have many issues. The same basin contains several valleys of rivers ; and when we examine nearly the polyedric surface of the Pampas and the portion of their waters which, like the waters of the steppes of Asia, do not go to the sea, we conceive that these plains are divided by small ridges or lines of elevation, and have alternate slopes, inclined, with reference to the horizon, in opposite directions. In order to point out more clearly the difference between geological and hydrographic views, and to prove that in the former, abstracting the course of the waters which meet in one recipient, we obtain a far more general point of view, I shall here again recur to the hydrographic basin of the Orinoco. That immense river rises on the southern slope of the Sierra Parime;
it is bounded by plains on the left bank, from the Cassiquiare to the mouth of the Atabapo, and flows in a basin which, geologically speaking, according to one great division of the surface of South America into three basins, we have called the basin of the Rio Negro and the Amazon. The low regions, which are bounded by the southern and northern declivities of the Parime and Brazil mountains, and which the geologist ought to mark by one name, contain, according to the no less precise language of hydrography, two basins of rivers, those of the Upper Orinoco and the Amazon, separated by a ridge that runs from Javita towards Esmeralda. From these considerations it results, that a geological basin (sit venia verbo) may have several recipients, and several emissaries, divided by small ridges almost imperceptible; it may at the same time contain waters that flow to the sea by different furrows independent of each other, and the systems of inland rivers flowing into lakes more or less charged with saline matter. A basin of a river, or hydrographic basin, has but one recipient, one emissary ; if, by a bifurcation, it gives a part of its waters to another hydrographic basin, it is because the bed of the river, or the principal recipient, approaches so near the banks of the basin or the ridge of partition that the ridge partly crosses it.

The distribution of the inequalities of the surface of the globe does not present any strongly marked limits between the mountainous country and the low regions, or geologic basins. Even where real chains of mountains rise like rocky dykes issuing from a crevice, spurs more or less considerable, seem to indicate a lateral upheaving. While I admit the difficulty of properly defining the groups of mountains and the basins or continuous plains, I have attempted to calculate their surfaces according to the statements contained in the preceding sheets.

## SOUTH AMERICA.

## I. Mountainous part: Square

| Andes | Marine Leagnee |
| :---: | :---: |
| Littoral Chain of Venezuela | 1,900 |
| Sierra Nevada de Merida ................................ | 200 |
| Group of the Parime | 25,800 |
| System of the Brazil mountains | 27,600 |
|  | 114,400 |



The whole surface of South America contains 571,300 square leagues ( 20 to a degree), and the proportion of the mountainous country to the region of the plains is as 1 to 3.9. The latter region, on the east of the Andes, comprises more than 424,600 square leagues, half of which consists of savannahs ; that is to say, it is covered with gramina.


#### Abstract

Section II. General Partition of ground-Direction and inclination of the strataRelative height of the formations above the level of the Ocean.


Is the preceding section we have examined the inequalities of the surface of the soil, that is to say, the general structure of the mountains, and the form of the basins rising between those variously grouped mountains. These mountains are sometimes longitudinal, running in narrow bands or chains, similar to the veins that preserve their directions at great distances, as the Andes, the littoral chain of Venezuela, the Serra do Mar of Brazil, and the Alleghanies of the United States. Sometimes they are in masses with irregular forms, in which upheavings seem to have taken place as on a labyrinth of crevices or a heap of veins, as for example in the Sierra Parime and the Serra dos Vertentes. These modes of formation are linked with a geognostic hypothesis, which has at least the recommendation of being founded on facts observed in remote times, and which strongly characterize the chains and groups of mountains. Considerations on the aspect of a country are independent of those which indicate the nature of the soil, the heterogeneity of matter, the superposition of rocks, and the direction and inclination of strata.

In taking a general view of the geological constitution of a chain of mountains, we may distinguish five elements of direction too often confounded in works of geognosy and physical geography. These elements are:-

1. The longitudinal axis of the whole chain.
2. The line that divides the waters (divortia aquarum).
3. The line of ridges or elevation passing along the maxima of height.
4. The line that separates two contiguous formations into horizontal sections.
5. The line that follows the fissures of stratification.

This distinction is the more necessary, there existing probably no chain on the globe that furnishes a perfect parallelism of all these directing lines. In the Pyrenees, for instance, $1,2,3$, do not coincide, but 4 and 5 (that is, the different formations which come to light successively, and the direction of the strata) are obviously parallel to 1 , or to the direction of the whole chain. We find so often in the most distant parts of the globe, a perfect parallelism between 1 and 5 , that it may be supposed that the causes which determine the direction of the axis (the angle under which that axis cuts the meridian), are generally linked with causes that determine the direction and inclination of the strata. This direction of the strata is independent of the line of the formations, or their visible limits at the surface of the soil; the lines 4 and 5 sometimes cross each other, even when one of them coincides with 1 , or with the direction of the longitudinal axis of the whole chain. The relief of a country cannot be precisely explained on a map, nor can the most erroneous opinions on the locality and superposition of the strata be avoided, if we do not apprehended with clearness the relation of the directing lines just mentioned.

In that part of South America to which this memoir principally relates, and which is bounded by the Amazon on the south, and on the west by the meridian of the Snowy Mountains (Sierra Nevada) of Merida, the different bands or zones of formations (4) are sensibly parallel withthe longitudinal axis (1) of the chains of mountains, basins, or interposed plains. It may be said in general that the gravitic zone (including under that denomination the rocks of granite, gneiss, and mica-slate) follows the direction of the Cordillera
of the shore of Venezuela, and belongs exclusirely to that Cordillera and the group of the Parime mountains; since it nowhere pierces the secondary and tertiary strata in the Llanos or basin of the Lower Orinoco. Thence it results, that the same formations do not constitute the region of plains and that of mountains.

If we may be allowed to judge of the structure of the whole Sierra Parime, from the part which I examined in $6^{\circ}$ of longitude, and $4^{\circ}$ of latitude, we may believe it to be entirely composed of gneiss-granite; I saw some beds of greenstone and amphibolic slate, but neither mica-slate, clay-slate, nor Danks of green limestone, although many phenomena render the presence of mica-slate probable on the east of the Maypures and in the chain of Pacaraina. The geological formation of the Parime group is consequently still more simple than that of the Brazilian group, in which granites, gneiss, and mica-slate, are covered with thonschiefer, chloritic quartz (Itacolumite), grauwacke, and transition-limestone; but those two groups exhibit in common the absence of a real system of secondary rocks; we find in both only some fragments of sandstone or silicious conglomerate. In the littoral Cordillera of Venezuela the granitic formations predominate ; but they are wanting towards the east, and especially in the southern chain, where we observe (in the missions of Caripe and around the gulf of Cariaco) a great accumulation of secondary and tertiary calcareous rocks. From the point where the littoral Cordillera is linked with the Andes of New Grenada (long. $71 \frac{1}{2}^{\circ}$ ), we observe first the granitic mountains of Aroa and San Felipe, between the rivers Yaracui and Tocuyo; these granitic formations extend on the east of the two coasts of the basin of the Valleys of Aragua, in the northern chain, as far as Cape Codera; and in the southern as far as the mountains (altas savanas) of Ocumare. After the remarkable interruption of the littoral Cordillera in the province of Barcelona, granitic rocks begin to appear in the island of Marguerita and in the isthmus of Araya, and continue, perhaps, towards the Boca del Drago; but on the east of the meridian of Cape Codera, the northern chain only is granitic (of micaceous slate); the southern chain is entirely composed of secondary limestone and sandstone.

If, in the granitic series, here a very complex forma-
tion, we would distinguish mineralogically between the rocks of granite, gneiss, and mica-slate, it must be borne in mind that coarse-grained granite, not passing to gneiss, is very rare in this country. It belongs peculiarly to the mountains that bound the basin of the lake of Valencia towards the north; for in the islands of that lake, in the mountains near the Villa de Cura, and in the whole northern chain, between the meridian of Vittoria and Cape Codera, gneiss predominates, sometimes alternating with granite, or passing to mica-slate. Mica-slate is the most frequent rock in the peninsula of Araya and the group of Macanao, which forms the western part of the island of Marguerita. On the west of Maniquarez, the mica-slate of the peninsula of Araya loses by degrees its semi-metallic lustre; it is charged with carbon, and becomes a clay-slate (thonschiefer) even an ampelite (alaunschiefer). Beds of granular limestone are most common in the primitive northern chain; and it is somewhat remarkable that they are found in gneiss, and not in micaslate.

We find at the back of this granitic, or rather micaslategneiss soil of the southern chain, on the south of the Villa de Cura, a transition stratum, composed of greenstone, amphibolic serpentine, micaceous limestone, and green and carburetted slate. The most southern limit of this district is marked by volcanic rocks. Between Parapara, Ortiz, and the Cerro de Flores (lat. $9^{\circ} 28^{\prime}-9^{\circ} 34^{\prime}$; long. $70^{\circ} 2^{\prime}-70^{\circ}$ 15'), phonolites and amygdaloids are found on the very border of the basin of the Llanos, that vast inland sea which once filled the whole space between the Cordilleras of Venezuela and Parime. According to the observations of Major Long and Dr. James, trap-formations (bulleuses dolerites and amygdaloids with pyroxene) also border the plains or basin of the Mississippi, towards the west, at the declivity of the Rocky Mountains. The ancient pyrogenic rocks which I found near Parapara where they rise in mounds with rounded summits, are the more remarkable as no others have hitherto been discovered in the whole eastern part of South America. The close connection observed in the strata of Parapara, between greenstone, amphibolic serpentine, and amygdaloids containing crystals of pyroxene; the form of the Morros of San Juan, which rise like cylinders above
the table-land; the granular texture of their limestone, surrounded by trap rocks, are objects worthy the attention of the geologist who has studied in the southern Tyrol, the effects produced by the contact of porozenic porphyries.*

The calcareous soil of the littoral Cordillera prevails most on the east of Cape Unare, in the southern chain; it extends to the gulf of Paria, opposite the island of Trinidad, where we find gypsum of Guire, containing sulphur. I have been informed that in the northern chain also, in the Montaña de Paria, and near Carupana, secondary calcareous formations are found, and that they only begin to shew themselves on the east of the ridge of rock called the Cerro de Meapire, which joins the calcareous group of Guacharo to the micaslate group of the peninsula of Araya; but I have not had an opportunity of ascertaining the accuracy of this information. The calcareous stratum of the southern chain is composed of two formations, which appear to be very distinct the one from the other: viz. limestone of Cumanacoa and that of Caripe. When I was on the spot, the former appeared to me to have some analogy with zechstein, or Alpine limestone; the latter with Jura limestone; I even thought that the granular gypsum of Guire might be that which belongs in Europe to zechstein, or is placed between zechstein and variegated sandstone. Strata of quartzose sandstone, alternating with slaty clay, cover the limestone of Cumanacoa, Cerro del Imposible, Turimiquiri, Guarda de San Agustin, and the Jura limestone in the province of Barcelona (Aguas Calientes). According to their position, these sandstones may be considered as belonging to the formation of green sandstone, or sandstone with lignites below chalk. But if, as I thought I observed at Cocollar, sandstone form strata in the Alpine limestone before it is superposed, it appears doubtful whether the sandstone of the Impossible, and of Aguas Calientes, constitute one series. Muriatiferous clay (with petroleum and lamellar gypsum) covers the western part of the peninsula of Araya, opposite to the town of Cumana, and in the

[^483]centre of the island of Marguerita. This clay appears to lie immediately over the mica-slate, and under the calcareous breccia of the tertiary strata. I cannot decide whether Araya, which is rich in disseminated muriate of soda, belongs to the sandstone formation of the Impossible, which from its position may be compared to variegated sandstone (red marl).

There is no doubt that fragments of tertiary strata surround the castle and town of Cumana (Castillo de San Antonio), and they also appear at the south-western extremity of the peninsula of Araya (Cerro de la Vela et del Barigon); at the ridge of the Cerro de Meapire, near Cariaco ; at Cabo Blanco, on the west of La Guayra, and on the shore of Porto Cabello; they are consequently found at the foot of the two slopes of the northern chain of the Cordillera of Venezuela. This tertiary stratum is composed of alternate beds of calcarcous conglomerate, compact limestone, marl, and clay, containing selenite and lamellar gypsum. The whole system (of very recent beds) appears to me to constitute but one formation, which is found at the Cerro de la Popa, near Carthagena, and in the islands of Guadaloupe and Martinico.

Such is the geological distribution of strata in the mountainous part of Venezuela, in the group of the Parime, and in the littoral Cordillera. We have now to characterize the formations of the Llanos (or of the basin of the Lower Orinoco and the Apure) ; but it is not easy to determine the order of their superposition, because in this region ravines or beds of torrents and deep wells dug by the hands of man are entirely wanting. The formations of the Llanos are, 1st, a sandstone or conglomerate, with rounded fragments of quartz, Lydian stone, and kieselschiefer, united by a ferruginous clayey cement, extremely tenacious, olive-brown, sometimes of a vivid red : 2nd, a compact limestone, (between Tisnao and Calabozo) which, by its smooth fracture, and lithographic aspect, approaches the Jura limestone: 3rd, alternate strata of marl and lamellar gypsum (Mesa de San Diego, Ortiz, Cachipo). These three formations appeared to me to succeed each other in the order I have just described, the sandstone inclining in a concave position, northward, on the transition-slates of Malpasso, and southward, on the gneiss-granite of Parime. As the gypsum often imme-
diately covers the sandstone of Calabozo, which appeared to me, on the spot, to be identical with our red sandstone, I am uncertain of the age of its formation. The secondary rocks of the Llanos of Cumana, Barcelona, and Caracas, occupy a space of more than 5000 square leagues. Their continuity is the more remarkable, as they appear to have no existence, at least on the east of the meridian of Porto Cabello ( $70^{\circ} 37^{\prime}$ ) in the whole basin of the Amazon, not covered by granitic sands. The causes which have favoured the accumulation of calcareous matter in the eastern region of the coast chain, in the Llanos of Venezuela (from $101^{\circ}$ to $8^{\circ}$ north), cannot have operated nearer the equator, in the group of the mountains of the Parime, and in the plains of the Rio Negro and the Amazon (lat. $1^{\circ}$ north, to $1^{\circ}$ south). The latter plains however, furnish some ledges of fragmentary rocks, on the south-west of San Fernando de Atabapo, as well as on the south-east, in the lower part of the Rio Negro and the Rio Branco. I saw in the plains of Jaen de Bracamoros a sandstone which alternates with ledges of sand and conglomerate nodules of porphyry and Lydian stone. MM. Spix and Martius affirm that the banks of the Rio Negro, on the south of the equator, are composed of variegated sandstone ; those of the Rio Branco, Jupura, and Apoporis, of quadersandstein; and those of the Amazon, on several points, of ferruginous sandstone.* It remains to examine if (as I am inclined to suppose) the limestone and gypsum formations of the eastern part of the littoral Cordillera of Venezuela differ entirely from those of the Llanos, and to what series belongs that rocky wall $\dagger$ named the Galera,

[^484]which bounds the steppes of Calabozo towards the north? The basin of the steppes is itself the bottom of a sea destitute of islands; it is only on the south of the Apure, between that river and the Meta, near the western bank of the Sierra, that a few hills appear, as Monte Parure, la Galera de Sinaruco, and the Cerritos de San Vicente. With the exception of the fragments of tertiary strata above mentioned, there is from the equator to the parallel of $10^{\circ}$ north (between the meridian of Sierra Nevada de Merida and the coast of Guiana), if not an absence, at least a scarcity of those petrifactions, which strikes an observer recently arrived from Europe

The maxima of the height of the different formations diminish regularly, in the country we are describing, with their relative ages. These maxima, for gneiss-granite (Peak of Duida in the group of Parime, Silla de Caracas in the coast chain) are from 1300 to 1350 toises; for the limestone of Cumanacoa (summit or Cucurucho of Turimiquiri), 1050 toises; for the limestone of Caripe (mountains surrounding the table-land of the Guarda de San Augustin), 750 toises; for the sandstone alternating with the limestone of Cumanacoa (Cuchilla de Guanaguana), 550 toises; for the tertiary strata (Punta Araya) 200 toises

The tract of country, of which I am here describing the geological constitution, is distinguished by the astonishing regularity observed in the direction of the strata of which the rocks of different eras are composed. I have already often pointed the attention of my readers to a geognostic law, one of the ferw that can be verified by precise measurements. Occupied since the year 1792, by the parallelism, or rather the loxodromism of the strata, examining the direction and inclination of the primitive and transition beds, from the coast of Genoa across the chain of the Bochetta, the plains of Lombardy, the Alps of Saint Gothard, the table-land of Swabia, the mountains of Bareuth, and the plains of Northern Germany, I was struck with the extreme frequency, if not the uniformity, of the horary directions 3
like Harudje (Mons Ater, Plin.) on the northern boundary of the African desert (the Sahara). Hills of sandstone rising like towers, walls, and fortified castles, and offering great analogy to quadersandstein, bound the American desert towards the west, on the south of Arkansas.
and 4 of the compass of Freiberg (direction fron south-west to north-east). This research, which I thought might lead to important discoveries relating to the structure of the globe, had then such attractions for me that it was one of the most powerful incentives of my voyage to the equator. My own observations, together with those of many able geologists,convince me that there exists in no hemisphere a general and absolute uniformity of direction; but that in regions of very considerable extent, sometimes over several thousand square leagues, we observe that the direction and (though more rarely) the inclination have been determined by a system of particular forces. We discover at great distances, a parallelism (loxodromism) of the strata, a direction, of which the type is manifest amidst partial perturbations, and which often remains the same in primitive and transition strata. A fact which must have struck Palasson and Saussure is, that in general the direction of the strata, even in those which are far distant from the principal ridges, is identical with the direction of mountain chains; that is to say, with their longitudinal axis.

Venezuela is one of the countries in which the parallelism of the strata of gneiss-granite, mica-slate, and clay-slate, is most strongly marked. The general direction of these strata is N. $50^{\circ} \mathrm{E}$., and the general inclination from $60^{\circ}$ to $70^{\circ}$ north-west. Thus I observed them on a length of more than a hundred leagues, in the littoral chain of Venezuela; in the stratified granite of Las Trincheras at Porto Cabello; in the gneiss of the islands of the lake of Valencia, and in the vicinity of the Villa de Cura; in the transition-slate and greenstone on the north of Parapara; in the road from La Guayra to the town of Caracas, and through all the Sierra de Avila in Cape Codera; and in the mica-slate and clay-slate of the peninsula of Araya. The same direction from N.E.to S. W., and this inclination to N. W., are also manifest, although less decidedly, in the limestones of Cumanacoa at Cuchivano, and between Guanaguana and Caripe. The exceptions to this general law are extremely rare in the gneissgranite of the littoral Cordillera; it may even be affirmed, that the inverse direction (from S. E. to N.W.) often bears with it the inclination towards S. W.

As that part of the group of the Sierra Parime over which

I passed, contains much more granite* than gneiss, and other rocks distinctly stratified, the direction of the layers could be observed in this group only on a small number of points; but I was often struck in this region with the continuity of the phenomenon of loxodromism. The amphibolic slates of Angostura run N. $45^{\circ}$ E., like the gneiss of Guapasoso which forms the bed of the Atabapo, and like the mica-slate of the peninsula of Araya, though there is a distance of 160 leagues between the limits of those rocks.

The direction of the strata, of which we have just noticed the wonderful uniformity, is not entirely parallel with the longitudinal axes of the two coast chains, and the chain of Parime. The strata generally cut the former of those chains at an angle of $35^{\circ}$, and their inclination towards the north-west becomes one of the most powerful causes of the aridity which prevails on the southern declivity $\dagger$ of the mountains of the coast. May we conclude that the direction of the eastern Cordillera of New Grenada, which is nearly N. $45^{\circ}$ E. from Santa Fe de Bogotà, to beyond the Sierra Nevada de Merida, and of which the littoral chain is but a continuation, has had an influence on the direction (hor. 3-4) of the strata in Venezuela ? That region presents a very remarkable losodromism with the strata of mica-slate, grauwacke, and the orthoceratite limestone of the Alleghanies, and that vast extent of country (lat. $56^{\circ}$ $68^{\circ}$ ) lately visited by Captain Franklin. The direction N. E. -S. W. prevails in every part of North America, as in Europe in the Fitchtelgebirge of Franconia, in Taunus, Westerwald, and Eifel; in the Ardennes, the Vosges, in Cotentin, in Scotland, and in the Tarentaise, at the southwest extremity of the Alps. If the strata of rocks in Venezuela do not exactly follow the direction of the nearest Cordillera, that of the shore, the parallelism between the axis of one chain, and the strata of the formations that compose it, are manifest in the Brazil group. $\ddagger$

* Only the granite of the Baragon is stratified, as well as crossed by veins of granite: the direction of the beds is $\mathrm{N} .20^{\circ} \mathrm{W}$.
$\dagger$ This southern declivity is however less rapid than the northern.
$\ddagger$ The strata of the primitive and intermediary rocks of Brazil run very regularly, like the Cordillera of Villarica (Serra do Espinhaço) hor. 1.4 or hor. 2 of the compass of Freiberg (N. $28^{\circ}$ E.)


## Section III.

Nature of the Rocks-Relative Age and Superposition of the Formations -Primitive, Transition, Secondary, Tertiary, and Volcanic Strata.

The preceding section has developed the geographical limits of the formations, the extent of the direction of the zones of gneiss-granite, micaslate-gneiss, clay-slate, sandstone, and intermediary limestone, which come successively to light. We will now indicate succinctly the nature and relative age of these formations. To avoid confounding facts with geologic opinions, I shall describe these formations, without dividing them, according to the method generally followed, into five groups-primitive, transition, secondary, tertiary, and volcanic rocks. I was fortunate enough to discover the types of each group in a region where, before I visited it, no rock had been named. The great inconvenience of the old classification is that of obliging the geologist to establish fixed demarcations, while he is in doubt, if not respecting the spot or the immediate superposition, at least respecting the number of the formations which are not developed. How can we in many circumstances determine the analogy existing, between a limestone with but few petrifactions and an intermediary limestone and zechstein, or between a sandstone superposed on a primitive rock and a variegated sandstone and quadersandstein, or finally, between muriatiferous clay and the red marl of England, or the gem-salt of the tertiary strata of Italy? When we reflect on the immense progress made within twenty-five years, in the knowledge of the superposition of rocks, it will not appear surprizing that my present opinion on the relative age of the formations of Equinoctial America is not identically the same with what I advanced in 1800. To boast of a stability of opinion in geology is to boast of an extreme indolence of mind; it is to remain stationary amidst those who go forward. What we observe in any one part of the earth on the composition of rocks, their subordinate strata, and the order of their position, are facts immutably
true, and independent of the progress of positive geology in other countries; while the systematic names applied to any particular formation of America, are founded only on the supposed analogies between the formations of America and those of Europe. Now those names cannot remain the same, if after further examination, the objects of comparison have not retained the same place in the geologic series; if the most able geologists now take for transition-limestoue and green sandstone, what they took formerly for zechstein and variegated sandstone. I believe the surest means by which geologic descriptions may be made to survive the change which the science undergoes in proportion to its progress, will be to substitute provisionally in the description of formations, for the systematic names of red sandstone, variegated sandstone, zechstein, and Jura limestone, names derived from American localities, as sandstone of the Llanos, limestone of Cumanacoa and Caripe, and to separate the enumeration of facts relative to the superposition of soils, from the discussion on the analogy of those soils with those of the Old World.*

[^485]
## I. Co-ordinate formations of Granite, Gnetss, and

 Mica-Slate.-There are countries (in France, the vicinity of Lyons; in Germany, Freiberg, Naundorf) where the formations of granite and gneiss are extremely distinct; there are others, on the contrary, where the geologic limits between those formations are slightly marked, and where granite, gneiss, and mica-slate appear to alternate by layers, or pass often from one to the other. These alternations and transitions appeared to me less common in the littoral Cordillera of Venezuela than in the Sierra Parime. We recognise successively, in the former of these two systems of mountains, above all in the chain nearest the coast, as predominating rocks from west to east, granite (long. $70^{\circ}-71^{\circ}$ ), gneiss (long. $68 \frac{1}{2}^{\circ}-70^{\circ}$ ), and mica-slate (long. $65 \frac{33^{\circ}}{}{ }^{-}-66 \frac{1}{2}^{\circ}$ ); but considering altogether the geologic consti-porphyries issue (like the trachytes of the Andes), in domes from the bosom of intermediary rocks. Porphyrific breccias, which envelope the quartzose porphyries. (b) Zechstein or Alpine limestone, with marly, bituminous slate, fetid limestone, and variegated gypsum (Productus aculeatus). (c) Variegated sandstone (bunter sandstein) with frequent beds of limestone; false oolites; the upper beds are of variegated marl, often muriatiferous (red marl, salzthon), with hydrated gypsum and fetid limestone. The gem-salt oscillates from zechstein to muschelkalk. (d) Limestone of Göttingen or muschelkalk, alternating towards the top with white sandstone or brittle sandstein. (Ammonitis nodosus, encrinites, Mytilus socialis) : clayey marl is found at the two extremities of muschelkalk. (e) White sandstone, brittle sandstein, alternating with lias, or limestone with graphites; a quantity of dicotyledonous mixed with monocotyledonous plants. ( $f$ ) Jura limestone of complex formation; a quantity of sandy intercalated marl. We most frequently observe, counting from below upwards; lias (marly limestone with gryphites), oolites, limestone with polypi, slaty limestone with fish, crustacea, and globules of oxide of iron (Amonites planulatus, Gryphæa arcuata). (g) Secondary sandstone with lignites; iron sand; Wealden clay; greensand, or green sandstone; ( $h$ ) Chlorite; tufted and white chalk; (planerkalk, limestone of Verona.)
IV. Tertiary strata, showing a much smaller number of dicotyledonous plants. (a) Clay and tertiary sandstone with lignites; plastic clay; mollasse, and nagelflihe, sometimes alternating, where chalk is wanting, with the last beds of Jura limestone; amber. (b) Limestone of Paris or coarse limestone, limestone with circles, limestone of Bolca, limestone of London, sandy limestone of Bognor ; lignites. (c) Silicious limestone, and gypsum with fossil bones alternating with marl. (d) Sandstone of Fon. tainbleau. (e) Lacustrine soil with porous millstone grit. (e) Alluyial deposits.
tution of the coast and the Sierra Parime, we prefer to treat of granite, gneiss, and mica-slate, if not as one formation, at least as three co-ordinate formations closely linked together. The primitive clay-slate (urthonschiefer) is subordinate to mica-slate, of which it is only a modification. It no more forms an independent stratum in the New Continent, than in the Pyrenees and the Alps.
(a) Granite which does not pass to gneiss is most common in the western part of the coast-chain between Turmero, Valencia, and Porto Cabello, as well as in the circle of the Sierra Parime, near the Encaramada, and at the Peak of Duida. At the Rincon del Diablo, between Mariara and Hacienda de Cura, and at Chuao, it is coarse-grained, and contains fine crystals of felspar, $1 \frac{1}{2}$ inches long. It is divided in prisms by perpendicular vents, or stratified regularly like secondary limestone, at Las Trincheras, the strait of Baraguan in the ralley of the Orinoco, and near Guapasoso, on the banks of the Atabapo. The stratified granite of Las Trincheras, giving birth to very hot springs (from $90.5^{\circ}$ cent.), appears from the inclination of its layers, to be superposed on gneiss which is seen further southward in the islands of the lake of Valencia; but conjectures of superposition founded only on the hypothesis of an indefinite prolongation of the strata, are doubtful; and possibly the granite masses which form a small particular zone in the northern range of the littoral Cordillera, between $70^{\circ} 3^{\prime}$ and $70^{\circ} 50^{\circ}$ long., were upheaved in piercing the gneiss. The latter rock is prevalent, both in descending from the Rincon del Diablo southward to the hot-springs of Mariara, and towards the banks of the lake of Valencia, and in advancing on the east towards the group of Buenavista, the Silla of Caracas, and Cape Codera. In the region of the littoral chain of Venezuela, where granite seems to constitute an independent formation from 15 to 16 leagues in length, I saw no foreign or subordinate layers of gneiss, mica-slate, or primitive limestone.*

[^486]The Sierra Parime is one of the most extensive granitic strata existing on the globe*; but the granite, which is seen alike bare on the flanks of the mountains and in the plains by which they are joined, often passes into gneiss. Granite is most commonly found in its granular composition and independent formation, near Encaramada, at the strait of Baraguan, and in the vicinity of the mission of the Esmeralda. It often contains, like the granites of the Rocky Mountains (lat. $38^{\circ}-40^{\circ}$ ), the Pyrenees, and Southern Tyrol, amphibolic crystals, $\dagger$ disseminated in the mass, but without passing to syenite. Those modifications are observed on the banks of the Orinoco, the Cassiquiare, the Atabapo, and the Tuamini. The blocks heaped together, which are found in Europe on the ridge of granitic mountains (the Riesengebirge in Silesia, the Ochsenkopf.in Franconia), are especially remarkable in the north-west part of the Sierra Parime, between Caycara, the Encaramada, and Uruana, in the cataracts of the Maypures and at the mouth of the Rio Vichada. It is doubtful whether these masses, which are of cylindrical form, parallelopipedons rounded on the edge, or balls of 40 to 50 feet in diameter, are the effect of a slow decomposition, or of a violent and instantaneous uphearing. The granite of the south-eastern part of Sierra Parime sometimes passes to pegmatite, $\ddagger$ composed of laminary felspar, enclosed in curved masses of crystalline quartz. I saw gneiss only in subordinate layers;§ but, between

[^487]Javita, San Carlos del Rio Negro, and the Peak of Duida, the granite is traversed by numerous veins of different ages, abounding with rock-crystal, black tourmalin, and pyrites. It appears that these open veins become more common on the east of the Peak of Duida, in the Sierra Pacaraina, especially between Xurumu and Rupunuri (tributaries of the Rio Branco and the Essequibo), where Hortsmann discovered, instead of diamonds* and emeralds, a mine (four) of rock-crystal.
(b) Gneiss predominates along the littoral Cordillera of Venezuela, with the appearance of an independent formation, in the northern chain from Cerro del Chuao, and the meridian of Choroni, as far as Cape Codera; and in the aouthern chain, from the meridian of Guigne to the mouth of the Rio Tuy. Cape Codera, the great mass of the Silla of Galipano, and the land between Guayra and Caracas, the table-land of Buenavista, the islands of the lake of Valencia, the mountains between Guigne, Maria Magdalena, and the Cerro de Chacao, are composed of gneiss; $\dagger$ yet amidst this soil of gneiss, inclosed mica-slate re-appears, often talcous in the Valle de Caurimare, and in the ancient Provincia de Los Mariches; at Cabo Blanco, west of La Guayra; near Caracas and Antimano, and above all, between the tableland of Buenavista and the valleys of Aragua, in the Montaña de las Cocuyzas, and at Hacienda del Tuy. Between

[^488]the limits here assigned to gneiss, as a predominant rock (long. $68 \frac{1}{2}^{\circ}-70 \frac{1}{2}^{\circ}$ ), gneiss passes sometimes to mica-slate, Nhile the appearance of a transition to granite is only found on the summit of the Silla of Caracas.* It would require a more careful examination than I was able to devote to the subject, to ascertain whether the granite of the peak of St. Gothard, and of the Silla of Caracas, really lies over micaslate and gneiss, or if it has merely pierced those rocks, rising in the form of needles or domes. The gneiss of the littoral Cordillera, in the province of Caracas, contains almost exclusively garnets, rutile titanite, and graphite, disseminated in the whole mass of the rock, shelves of granular limestone, and some metalliferous veins. I shall not decide whether the granitiferous serpentine of the table-land of Buenavista is inclosed in gneiss, or whether, superposed upon that rock, it does not rather belong to a formation of weisstein (heptinite) similar to that of Penig and Mittweyde in Saxony.

In that part of the Sierra Parime which M. Bonpland and myself visited, gneiss forms a less marked zone, and oscillates more frequently towards granite than mica-slate. I found no garnets in the gneiss of Parime. There is no doubt that the gaeiss-granite of the Orinoco is slightly auriferous on some points.
(c) Mica-slate, with clay-slate (thonschiefer), forms a continuous stratum in the northern chain of the littoral Cordillera, from the point of Araya, beyond the meridian of Cariaco, as well as in the island of Marguerita. It contains, in the peninsula of Araya, garnets disseminated in the mass, cyanite, and, when it passes to clayey-slate, small layers of native alum. Mica-slate constituting an independent formation, must be distinguished from mica-slate subordinate to a stratum of gneiss, on the east of Cape Codera. The micaslate subordinate to gneiss, presents, in the valley of Tuy, shelves of primitive limestone and small strata of graphic ampelite (zeicheschiefer); between Cabo Blanco and Catia, layers of chloritic, granitiferous slate, and slaty amphibole;

[^489]and between Caracas and Antimano, the more remarkable phenomenon of veins of gneiss inclosing balls of granitiferous diorite (grünstein).

In the Sierra Parime, mica-slate predominates only in the most eastern part, where its lustre has led to strange errors.

The amphibolic slate of Angostura, and masses of diorite in balls, with concentric layers, near Muitaco, appear to be superposed, not on mica-slate, but immediately on gneissgranite. I could not, however distinctly ascertain whether a part of this pyritous diorite was not enclosed on the banks of the Orinoco, as it is at the bottom of the sea near Cabo Blanco, and at the Montaña de Avila, in the rock which it covers. Very large veins, with an irregular direction, often assume the aspect of short layers; and the balls of diorite heaped together in hillocks, may, like many cones of basalt, issued from the crevices.

Mica-slate, chloritic slate, and the rocks of slaty amphibole, contain magnetic sand in the tropical regions of Venezuela, as in the most northern regions of Europe. The garnets are there almost equally disseminated in the gneiss (Caracas), the mica-slate (peninsula of Araya), the serpentine (Buenavista), the chloritic slate (Cabo Blanco), and the diorite or greenstone (Antimano). These garnets re-appear in the trachytic porphyries that crown the celebrated metalliferous mountain of Potosi, and in the black and pyroxenic masses of the small volcano of Yana-Urca, at the back of Chimborazo.

Petroleum, (and this phenomenon is well worthy of attention) issues from a soil of mica-slate in the gulf of Cariaco. Further east, on the banks of the Arco, and near Cariaco, it seems to gush from secondary limestone formations, but probably that happens only because those formations repose on mica-slate. The hot springs of Venezuela have also their origin in, or rather below, the primitive rocks. They issue from granite (Las Trincheras), gneiss (Mariara and Onoto), and the calcareous and arenaceous rocks that cover the primitive rocks (Miorros de San Juan, Bergantin, Cariaco). The earthquakes and subterraneous detonations, of which the seat has been erroneously sought in the calcareous mountains of Cumana, have been felt with
most violence in the granitic soils of Caracas and the Orinoco. Igncous phenomena (if their existence be really well certified) are attributed by the people to the granitic peaks of Duida and Guaraco, and also to the calcareous mountain of Cuchivano.

From these observations, it results that gneiss-granite predominates in the immense group of the mountains of the Parime, as micaslate-gneiss prevails in the Cordillera of the coast; that in the two systems, the granitic soil, unmixed with gneiss and mica-slate, occupies but a very small extent of country; and that in the coast-chain the formations of clayey slate (thonschiefer), mica-slate, gneiss, and granite, succeed each other in such a manner on the same line from east to west (presenting a very uniform and regular inclination of their strata towards the norih-west), that, according to the hypothesis of a subterraneous prolougation of the strata, the granite of Las Trincheras and the Rincon del Drablo may be superposed on the gueiss of the Villa de Cura, of Buenavista, and Caracas; and the gneiss superposed in its turn on the mica-slate and clay-slate of Maniquarez and Chuparuparu in the peninsula of Araya. This hypothesis of a prolongation of every rock, in some sort indefinite, founded on the angle of inclination presented by the strata appearing at the surface, is not admissible; and according to similar equally vague reasoning, we should be forced to consider the primitive rocks of the Alps of Switzerland as superposed on the formation of the compact limestone of Achsenberg, and that [transition, or identical with zechstein?] in turn, as being superposed on the molassus of the tertiary strata.
II. Formation of the clat-slate (thonschiefer) of Malpasso.-If, in the sketch oif the formations of Venezuela, I had followed the received division into primitive, intermediary, secondary, and tertiary strata, I might be doubtful what place the last stratum of mica-slate in the peninsula of Araya should occupy. This stratum, in the ravine (aroyo) of Robalo, passes insensibly in a carburetted and shining slate, into a real ampelite. The direction and inclination of the stratum remain the same, and the thonschiefer, which takes the look of a transition-rock, is but a 20
modification of the primitive mica-slate of Maniquarez, containing garnets, cyanite, and rutile titanite. These insensible passages from primitive to transition strata, by clay-slate, which becomes carburetted at the same time that it presents a concordant position with mica-slate and gneiss, have also been observed several times in Europe by celebrated geologists. The existence of an independent formation of primitive slate (urthonschiefer), may even be doubted, that is, of a formation which is not joined below by strata containing some vestiges of monocotyledonous plants.

The small thonschiefer bed of Malpasso (in the southern chain of the littoral Cordillera, is separated from micaslategneiss by a co-ordinate formation of serpentine and diorite. It is divided into two shelves, of which the upper presents green steatitous slate mixed with amphibole, and the lower, dark-blue slate, extremely fissile, and traversed by numerous veins of quartz. I could discover no fragmentary stratum (grauwacke), nor kieselschiefer nor chiastolithe. The kieselschiefer belongs in those countries to a limestone formation. I have seen fine specimens of the chiastolithe (macle), which the Indians wore as amulets, and which came from the Sierra Nevada de Meriaa. This substance is probably found in transition-slate, for MM. Rivero and Boussingault observed rocks of clay-slate at the height of 2120 toises, in the Paramo of Mucuchies, on going from Truxillo to Merida.*
III. Formation of Serpentine and Diorite (Greenstone of Juncalito.)-We have indicated above, a layer of granitiferous serpentine inclosed in the gneiss of Buenavista, or perhaps superposed on that rock; we here find a real stratum of serpentine alternating with diorite, and extending from the ravine of Tucutunemo as far as Juncalito. Diorite forms the great mass of this stratum; it is of a darkgreen colour, granular, with small grains, and destitute of

[^490]quartz; its mass is formed of small crystals of felspar, intermixed with crystals of amphibole. This rock of diorite is covered at its surface, by the effect of decomposition, with a yellowish crust, like that of basalts and dolerites. Serpentine, of a dull olive-green and smooth fracture, mixed with bluish steatite and amphibole, presents, like almost all the co-ordinate formations of diorite and serpentine (in Silesia, at Fichtelgebirge, in the valley of Baigorry, in the Pyrenees, in the island of Cyprus, and in the Copper Mountains of circumpolar America),* traces of copper. Where the diorite, partly globular, approaches the green slate of Malpasso, real beds of green slate are found inclosed in diorite. The fine saussurite which we saw in the Upper Orinoco in the hands of the Indians, seems to indicate the existence of a soil of euphotide, superposed on gneissgranite, or amphibolic slate, in the eastern part of the Sierra Parime.
IV. Granular and micaceots Limestone of the Morros of San Juan.-The Morros of San Juan rise like ruinous towers in a soil of diorite. They are formed of a cavernous greyish green limestone of crystalline texture, mixed with some spangles of mica, and are destitute of shells. We see in them masses of hardened clay, black, fissile, charged with iron, and covered with a crust, yellow from decomposition, like basalts and amphiboles. A compact limestone containing vestiges of shells, adjoins this granular limestone of the Morros of San Juan, which is hollow within. Probably on a further examination of the extraordinary strata between Villa de Cura and Ortiz, of which I had time only to collect some few specimens, many phenomena may be discovered analogous to those which Leopold von Buch has lately described in South Tyrol. M. Boussingault, in a memoir which he has recently addressed to me, calls the rock of the Morros a "problematic calcariferous gneiss." This expression seems to prove that the plates of mica take in some parts a uniform direction, as in the greenish dolomite of Val Toccia.

* Franklin's Journey to the Polar Sea, p. 520.
V. Felspathic Sanditone of the Orinoco. - The gneiss-granite of the Sierra Parime is covered in some ferr places (betreen the Encaramada and the strait of Baraguan, and in the island of Guachaco), in its western part, with an olive-brown sandstone, containing grains of quartz and fragments of felspar, joined by an extremely compact clayey cement. This cement, where it abounds, has a conchoidal fracture, and passes to jasper. It is crossed by small veins of brown iron-ore, which separate into very thin plates or scales. The presence of felspar seems to indicate that this small formation of sandstone (the sole secondary formation hitherto known in the Sierra Parime), belongs to red sandstone or coal.* I hesitate to class it with the sandstone of the Llanos, the relative antiquity of which appears to me to be less satisfactorily verified.
VI. Formation of the Sandstone of the Llanos of Calabozo.-I arrange the various formations in the order which I fancied I could discern on the spot. The carburetted slate (thonschicfer) of the peninsula of Araya connects the primitive rocks of gneiss-granite and micaslate-gueiss with the transition strata (blue and green slate, diorite, serpentine mixed with amphibole, and granular greenish-grey limestone) of Malpasso, Tucutunemo, and San Juan. On the south, the sandstone of the Llanos rests on this transition strata; it is destitute of shells, and composed, like the savannahs of Calabozo, of rounded fragments of quartz, $\dagger$ kieselschiefer, and Lydian stone, cemented by a ferruginous olive-brown clay. We there find fragments of wood, in great part monocotyledonous, and masses of brown iron-ore. Some strata, as in the Mesa de Paja, present grains of very

[^491]tine quartz; I saw no fragments of porphyry or limestone. Those immense beds of sandstone that cover the Llanos of the Lower Orinoco and the Amazon, well deserve the attention of travellers. In appearance they approximate to the pudding-stones of the molassus stratum, in which calcareous vestiges are also often wanting, as at Schottwyl and Diesbach in Switzerland; but they appeared to me by their position to have more relation to red sandstone. Nowhere can they be confounded with the grauwackes (fragmentary tran-sition-rocks) which MM. Boussingault and Rivero found along the Cordilleras of New Grenada, bordering the steppes on the west. Does the want of fragments of granite, gneiss, and porphyry, and the frequency of petrified wood,* sometimes dicotyledonous, indicate that those sandstones belong to the more recent formations which fill the plains between the Cordillera of the Parime and the coast Cordillera, as the molassus of Switzerland fills the space between the Jura and the Alps? It is not easy, when several formations are not perfectly developed, to determine the age of arenaceous rocks. The most able geologists do not concur in opinion respecting the sandstone of the Black Forest, and of the whole country south-west of the Thuringer Waldgebirge. M. Boussingault, who passed through a part of the steppes of Venezuela long after me, is of opinion that the sandstone of the Llanos of San Carlos, that of the valley of San Antonio de Cucuta, and the table-lands of Barquisimeto, Tocuyo, Merida, and Truxillo, belong to a formation of old red sandstone, or coal. There is in fact real coal near Carache, south-west of the Paramo de las Rosas.

Before a part of the immense plains of America was geologically examined, it might have been supposed that

[^492]their uniform and continued horizontality was caused by alluvial soils, or at least by arenaceous tertiary strata. The sands which in the Baltic provinces, and in all the north of Germany, cover coarse limestone and chalk, seem to justify these systematic ideas, which have been extended to the Sahara, and the steppes of Asia. But the observations which we have been able to collect, sufficiently prove that both in the Old and the New World, both plains, steppes, and deserts contain numerous formations of different æras, and that these formations often appear without being covered by alluvial deposits. Jura limestone, gem-salt, (plains of the Meta and Patagonia), and coal-sandstone, are found in the Llanos of South America; quadersandstein,* a saliferous soil, beds of coal, $\dagger$ and limestone with trilobites, $\ddagger$ fill the vast plains of Louisiana and Canada. In examining the specimens collected by the indefatigable Caillaud in the Lybian desert and the Oasis of Siwa, we recognize sandstone similar to that of Thebes; fragments of petrified dicotyledonous wood (from thirty to forty feet long), with rudiments of branches and medullary concentric layers, coming perhaps from tertiary sandstone with lignites§; chalk with spatangi and anachytes, Jura limestone with nummulites partly agatized; another fine grained limestone\| employed in the construction of the temple of Jupiter Ammon (Omm-Beydah); and gem-salt with sulphur and bitumen. These examples sufficiently prove that the

[^493]plains (llanos), steppes, and deserts, have not that uniform tertiary formation which has been too generally supposed. Do the fine pieces of riband-jasper, or Egyptian pebbles, which M. Bonpland picked up in the savannahs of Barcelona (near Curataquiche), belong to the sandstone of the Llanos of Calabozo, or to a stratum superposed on that sandstone? The former of these suppositions would approach, according to the analogy of the observations made by M. Rozière in Egypt, the sandstone of Calabozo, or tertiary nagelfluhe.
VII. Formation of the Compact Limestone of Cumanacoa.-A bluish-grey compact limestone, almost destitute of petrifactions, and frequently intersected by small reins of carburetted lime, forms mountains with very abrupt ridges. These layers have the same direction and the same inclination as the mica-slate of Araya. Where the flank of the limestone mountains of New Andalusia is very steep, we observe, as at Achsenberg, near Altdorf, in Switzerland, layers that are singularly arched or turned. The tints of the limestone of Cumanacoa vary from darkish grey to bluish white, and sometimes pass from compact to granular. It contains, as substances accidentally disseminated in the mass, brown iron-ore, spathic iron, even rock-crystal. As subordinate layers, it contains (1) numerous strata of carburetted and slaty marl, with pyrites; (2) quartzose sandstone, alternating with very thin strata of clayey slate; (3) gypsum with sulphur, near Guire, in the Golfo Triste, on the coast of Paria. As I did not examine on the spot the position of this yellowish-white fine-grained gypsum, I cannot determine with any certainty its relative age.

The only petrifactions of shells which I found in this limestone formation consist of a heap of turbinites and trochites, on the flank of Turimiquiri, at more than 680
the limestone with nummulites, of Siwa. The primitive rocks from which the fine-grained marble was believed to be extracted, if there be no deception in its granular appearance, are far distant from the Oasis of Siwa.
*This sandstone contains springs. In general it only covers the limestone of Cumanacoa, but it appeared to me to be sometimes enclosed.
toises high, and an ammonite seven inches in diameter, in the Montaña de Santa Maria, north-north-west of Caripe. I nowhere saw the limestone of Cumanacoa (of which I treat specially in this article) resting on the sandstone of the Llanos; if there be any such superposition, it must be found on descending the table-land of Cocollar towards the Mesa de Amana. On the southern coast of the gulf of Cariaco, the limestone formation probably covers, without the interposition of another rock, a mica-slate which passes to carburetted clay-slate. In the northern part of the gulf I distinctly saw this clayey formation at the depth of two or three fathoms in the sea. The submarine hot springs appeared to me to gush from mica-slate like the petroleum of Maniquarez. If any doubts remain as to the rock on which the limestone of Cumanacoa is immediately superposed, there is none respecting the rocks which cover it, such as (1) the tertiary limestone of Cumana, near Punta Delgada, and at Cerro de Meapire; (2) the sandstone of Quetepe and Turimiquiri, which, forming layers also in the limestone of Cumanaco, belongs properly to the latter soil; the limestone of Caripe, which we have often identified in the course of this work, with Jura limestone, and of which we shall speak in the following article.

VliI. Formation of tie Compact Limestone of Caripe.-Descending the Cuchillo de Guanaguana towards the convent of Caripe, we find another more recent formation, white, with a smooth or slightly conchoidal fracture, and divided in very thin layers, which succeeds to the bluish grey limestone formation of Cumanacoa. I call this in the first instance the limestone formation of Caripe, on account of the cavern of that name, inhabited by thousands of nocturnal birds. This limestone appeared to me identical (1) with the limestone of the Morro de Barcelona and the Chimanas Islands, which contains small layers of black kieselschiefer (slaty jasper) without veins of quartz, and breaking into fragments of parallelopiped form ; (2) with the whitish grey limestone with smooth fracture, of Tisnao, which seems to cover the sandstone of the Llanos. We find the formation of Caripe in the island of Cuba (between the

Havannah and Batabano, and between the port of Trinidad and Rio Guaurabo), as well in the small Cayman Islands.

I have hitherto described the secondary limestone formations of the littoral chain without giving them the systematic names which may connect them with the formations of Europe. During my stay in America, I took the limestone of Cumanacoa for zechstein or Alpine limestone, and that of Caripe for Jura limestone. The carburetted and slightly bituminous marl of Cumanacoa, analogous to the strata of bituminous slate, which are very numerous* in the Alps of southern Bavaria, appeared to me to characterize the former of these formations; while the dazzling whiteness of the cavernous stratum of Caripe, and the form of those shelves of rocks rising in walls and cornices, forcibly reminded me of the Jura limestone of Streitberg in Franconia, or of Oitzow and Krzessowic, in Upper Silesia. There is in Venezuela a suppression of the different strata which, in the old continent, separate zechstein from Jura limestone. The sandstone of Cocollar, which sometimes covers the limestone of Cumanacoa, may be considered as variegated sandstone; but it is more probable that in alternating by layers with the limestone of Cumanacoa, it is sometimes thrown to the upper limit of the formation to which it belongs. The zechstein of Europe also con. tains a very quartzose sandstone. The two limestone strata of Cumanaco and Caripe succeed immediately each other, like Alpine and Jura limestone, on the western declivity of the Mexican table-land, between Sopilote, Mescala, and Tehuilotepec. These formations, perhaps, pass from one to the other, so that the latter may be only an upper shelf of zechstein. This immediate covering, this suppression of interposed soils, this simplicity of structure, and absence of oolitic strata, have been equaily observed in Upper Silesia and in the Pyrenees. On the other hand, the immediate superposition of the limestone of Cumanacoa on mica-slate and transition clay-slate,- the rarity of the petrifactions which have not yet been sufficiently examined,- the strata of silex passing to Lydian stone, may lead to the belief that the soils of Cumanacoa and Caripe are of much more ancient

[^494]formation than the secondary rocks. We must not be surprised that the doubts which arise in the mind of the geologist when endeavouring to decide on the relative age of the limestone of the high mountains in the Pyrences, the Apennines (south of the lake of Perugia), and in the Swiss Alps, should extend to the limestone strata of the high mountains of New Andalusia, and everywhere in America where the presence oí red sandstone is not distinctly recognized.
IX. Sandstone of tife Bergantin.-Between Nueva Barcelona and the Cerro del Bergantin a quartzose sandstone covers the Jura limestone of Cumanacon. Is it an arenaceous rock analogous to green sandstone, or does it belong to the sandstone of Cocollar? In the latter case, its presence seems to prove still more clearly that the limestones of Cumanaco and Caripe are only two parts of the same system, alternating with sandstone, sometimes quartzose, sometimes slaty.
X. Gypsum of the Lianos of Venezdela.-Deposits of lamellar gypsum, containing numerous strata of marl, are found in patches on the steppes of Caracas and Barcelona; for instance, in the table-land of San Diego, between Ortiz and the Mesa de Paja; and near the mission of Cachipo. They appeared to me to cover the Jura limestone of Tisnao, which is analagous to that of Caripe, where we find it mixed with masses of fibrous gypsum. I have not given the name formation either to the sandstone of the Orinoco, of Cocollar, of Bergantin, or to the gypsum of the Llanos, because nothing as yet proves the independence of those arenaceous and gypsous soils. I think it will one day be ascertained that the gypsum of the Llanos covers not only the Jura limestone of the Llanos, but that it is sometimes enclosed in it like the gypsum of the Golfo Triste on the east of the Alpine limestone of Cumanacoa. The great masses of sulphur found in the layers, almost entirely clayey, of the steppes (at Guayuta, valley of San Bonifacio, Buen Pastor, confluence of the Rio Pao with the Orinoco), may possibly belong to the marl of the gypsum of Ortiz. These clayey beds are more worthy of attention since the interesting observations of Von Buch, and several other celebrated geologists, respecting the cavernosity of gypsum, the irre-
gularity of the inclination of its strata, and its parallel position with the two declivities of the Hartz and the upheaved chain of the Alps; while the simultaneous presence of sulphur, oligist iron, and the sulphurous acid vapours which precede the formation of sulphuric acid, seem to manifest the action of forces placed at a great depth in the interior of the globe.

## XI. Formation of Muriatiferods Clay (with Bitu-

 men and Lamellar Gypsum) of the Peninstla of Araya.-This soil presents a striking analogy with salzthon or leberstein (muriatiferous clay), which I have found accompanying gem-s:lt in every zone. In the salt-pits of Araya (Haraia), it sttracted the attention of Peter Martyr d'Anghiera, at the beginning of the sixteenth century. It probably facilitated the rupture of the earth, and the formation of the gulf of Cariaco. This clay is of a smoky colour, impregnated with petroleum, mingled with lamellar and lenticular gypsum, and sometimes traversed by small veins of fibrous gypsum. It incloses angular and less friable masses of dark brown clay, with a slaty and sometimes conchoidal fracture. Muriate of soda is found, in particles invisible to the naked eye. The relations of position or superposition between this soil and the tertiary rocks does not appear sufficiently clear to enable me to pronounce with certainty on this element, the most important of positive geology. The co-ordinate layers of gem-salt, muriatiferous clay, and gypsum, present the same difficulties in both hemispheres; these masses, the forms of which are very irregular, everywhere exhibit traces of great commotions. They are scarcely ever covered by independent formations; and after having been long believed, in Europe, that gem-salt was exclusively peculiar to Alpine and transition limestone, it is now still more generally admitted, either from reasoning founded on analogy or from suppositions on the prolongation of the strata, that the true location of gem-salt is found in variegated sandstone (buntersandstein). Sometimes gemsalt appears to oscillate between variegated sandstone and muschelkalk.I made two excursions on the peninsula of Araya. In the first, I was inclined to consider the muriatiferous clay
as subordinate to the conglomerate (evidently of tertiary formation) of the Barigon and of the mountain of the castle of Cumana, because a little to the north of that castle I had found shelves of hardened clay containing lamellar gypsum inclosed in the tertiary strata. I believed that the muriatiferous clay might alternate with the calcareous conglomerate of Barigon; and near the fishermen's huts situated opposite Macanao, conglomerate rocks appeared to me to pierce through the strata of clay. During a second excursion to Maniquarez and the aluminiferous slates of Chaparuparu, the connexion between tertiary strata and bituminous clay seemed to me somewhat problematical. I examined more particularly the Peñas Negras near the Cerro de la Vela, E.S.E. of the ruined castle of Araya. The limestone of the Peñas is compact, bluish grey, and almost destitute of petrifactions. It appeared to me to be much more ancient than the tertiary conglomerate of Barigon, and I saw it covering, in concordant position, a slaty clay, somewhat analogous to muriatiferous clay. I was greatly interested in comparing this latter formation with the strata of carburetted marl contained in the Alpine limestone of Cumanacoa. According to the opinions now most generally received, the rock of the Peñas Negras may be considered as representing muschelkalk (limestone of Göttingen); and the saliferous and bituminous clay of Araya, as representing variegated sandstone; but these problems can only be solved when the mines of those countries are worked. Those geologists who are of opinion that the gem-salt of Italy penetrates into a stratum above the Jura limestone, and even the chalk, may be led to mistake the limestone of the Peñas Negras for one of the strata of compact limestone without grains of quartz and petrifactions, which are frequently found amidst-the tertiary conglomerate of Barigon and of the Castillo de Cumana; the saliferous clay of A raya would appear to them analogous to the plastic clay of Paris,* or to the clayey shelves (dief et tourtia) of secondary sandstone with lignites, containing salt-springs, in Belgium and Westphalia. However difficult it may be to distinguish separately the strata of marl and clay belonging to variegated sandstone, muschel-

[^495]kalk, quadersandstein, Jura limestone, secondary sandstone with lignites (green and iron sand), and the tertiary strata lying above chalk, I believe that the bitumen which everywhere accompanies gem-salt, and most frequently saltsprings, characterizes the muriatiferous clay of the peninsula of Araya and the island of Marguerita, as linked with formations lying below the tertiary strata. I do not say that they are anterior to that formation, for since the publication of M. von Buch's observations on the Tyrol, we must no longer consider what is below, in space, as necessarily anterior, relatively to the epoch of its formation.

Bitumen and petroleum still issue from the mica-slate; these substances are ejected whenever the soil is shaken by a subterranean force (between Cumana, Cariaco, and the Golfo Triste). Now, in the peninsula of Araya, and in the island of Marguerita, saliferous clay impregnated with bitumen is met with in connexion with this early formation, nearly as gem-salt appears in Calabria in flakes, in basins inclosed in strata of granite and gneiss. Do these circumstances serve to support that ingenious system, according to which all the co-ordinate formations of gypsum, sulphur, bitumen, and gem-salt (constantly anhydrous) result from floods passing across the crevices which have traversed the oxidated crust of our planet, and penetrating to the seat of volcanic action. The enormous masses of muriate of soda recently thrown up by Vesuvius,* the small veins of that salt which I have often seen traverse the most recently ejected lavas, and of which the origin (by sublimation) appears similar to that of oligist iron deposited in the same vents, $\dagger$ the layers of gem-salt and saliferous clay of the trachytic soil in the plains of Peru, and around the volcano of the Andes of Quito, are well worthy the attention of geologists who would discuss the origin of formations. In the present sketch I confine myself to the mere enumeration of the phenomena of position, indicating, at the same time, some theoretic views, by which observers, in more advan-

[^496]tageous circumstances than I was myself, may direct their researches.
XII. Agglomerate Limpstone of the Barigon, of the Castle of Cumana, and of the vicinity of Porto Cabello.-This is a very complex formation, presenting that mixture and that periodical return of compact limestone, quartzose sandstone, and conglomerates (limestone breccia) which in every zone peculiarly characterises the tertiary strata. It forms the mountain of the castle of San Antonio near the town of Cumana, the south-west extremity of the peninsula of Araya, the Cerro Meapire, south of Caraco, and the vicinity of Porto Cabello. It contains (1) a compact limestone, generally of a whitish grey, or yellowish white (Cerro del Barigon), some very thin layers of which are entirely destitute of petrifactions, while others are filled with cardites, ostracites, pectens, and vestiges of lithophyte polypi : (2) a breccia in which an innumerable number of pelagic shells are found mixed with grains of quartz agglutinated by a cement of carbonate of lime: (3) a calcareous sandstone with very fine rounded grains of quartz (Punta Arenas, west of the village of Maniquarez), and containing masses of brown iron ore: (4) banks of marl and slaty clay, containing no spangles of mica, but enclosing selenite and lamellar gypsum. These banks of clay appeared to me constantly to form the lower strata. There also belongs to this tertiary stratum, the limestone tufa (freshwater formation) of the valleys of Aragua near Vittoria, and the fragmentary rock of Cabo Blanco, westward of the port of La Guayra. I must not designate the latter by the name of nagelfluhe, because that term indicates rounded frag. ments, while the fragments of Cabo Blanco are generally angular, and composed of gneiss, hyaline quartz, and chloritic slate, joined by a limestone cement. This cement contains magnetic sand,* madrepores, and vestiges of bivalve sea shells. The different fragments of tertiary strata which I found in the littoral Cordillera of. Venezuela, on the two slopes of the northern chain, seem to be superposed near Cumana (between Bordones and Punta Delgada); in the

* This magnetic sand no doubt owes its origin to chloritous slate, which, in these latitudes, forms the bed of the sea.

Cerro of Meapire ; on the [Alpine] limestone of Cumanacoa; between Porto Cabello and the Rio Guayguaza; as well as in the valleys of Aragua; on granite; on the western declivity of the hill formed by Cabo Blanco, on gneiss; and in the peninsula of Araya, on saliferous clay. But this is perhaps merely the effect of apposition.* It we would range the different members of the tertiary series according to the age of their formation, we ought, I believe, to regard the breccia of Cabo Blanco with fiagments of primitive rocks, as the most ancient, and make it be succeeded by the arenaceous limestone of the castle of Cumana, without horned silex, yet somewhat analagous to the coarse limestone of Paris, and the fresh-water soil of Victoria. The clayey gypsum, mixed with calcareous breccia with madrepores, cardites, and oysters, which I found between Carthagena and the Cerro de la Popa, and the equally recent limestones of Guadalope, and Barbadoes (limestones filled with seashells resembling those now existing in the Caribbean Sea) prove that the latest deposited strata of the tertiary formation extend far towards the west and north.

These recent formations, so rich in vestiges of organized bodies, furnish a vast field of observation to those who are familiar with the zoological character of rocks. To examine these vestiges in strata superposed as by steps, one above another, is to study the Fauna of different ages, and to compare them together. The geography of animals marks out limits in space, according to the diversity of climates, which determine the actual state of vegetation on our planet. The geology of organized bodies, on the contrary, is a fragment of the history of nature, taking the word history in its proper acceptation : it describes the inhabitants of the earth according to succession of time. We may study genera and species in museums, but the Fauna of different ages the predominance of certain shells, the numerical relations which characterize the animal kingdom, and the vegetation of a place or of a period, should be studied in sight of those formations. It has long appeared to me that in the tropics as well as in the temperate zone, the species of univalve shells are much more numerous than bivalves. From

[^497]this superiority in number, the organic fossil world furnishes, in every latitude, a further analogy with the intertropical shells that now live at the bot tom of the ocean. In fact, M. Defrance, in a work* full of new and ingenious ideas, not only recognizes this preponderance of the univalves in the number of the species, but also observes, that out of 5500 fossil univalve, bivalve, and multivalve shells, contained in his rich collections, there are 3066 univalve, 2108 bivalre, and 326 multivalve; the univalve fossils are therefore to the bivalve as three to two.
XIII. Formation of Prroxenic Amygdaloid and Phonolite, between Ortiz and Cerro de Flomes.-I place pyroxenic anygdaloid and phonolite (porphyrschiefer) at the end of the formations of Venezuela, not as being the only rocks which I consider as pyrogenous, but as those of which the volcanic origin is probably posterior to the tertiary strata. This conclusion is not deduced from the observations I made $a^{2}$ the southern declivity of the littoral Cordillera, between the Morros of San Juan, Parapara, and the Llanos of Calabozo. In that region, local circumstances would possibly lead us to regard the amygdaloids of Ortiz as linked to a system of transition rocks (amphibolic serpentine, diorite, and carburetted slate of Malpasso); but the eruption of the trachytes across rocks posterior to the chalk (in the Euganean Mountains, and other parts of Europe), joined to the phenomenon of total absence of fragments of pyroxenic porphyry, trachyte, basalt, and phonolite, $\dagger$ in the conglomerates or fragmentary rocks anterior to the recent tertiary strata, renders it probable that the appearance of trap rocks at the surface of the earth is the effect of one of the last revolutions of our planet, even where the eruption has taken place by crevicis (veins) which cross gneiss-granite, or the transition rocks not covered by secondary and tertiary formations.

[^498]The small volcanic stratum of Ortiz (lat. $9^{\circ} 28^{\prime}-9^{\circ} 36^{\prime}$ ) formed the ancient shore of the vast basin of the Llanos of Venezuela: it is composed on the points where I could examine it, of only two kinds of rocks, namely, amygdaloid and phonolite. The greyish blue amygdaloid contains fendillated crystals of pyroxene and mesotype. It forms balls with concentric layers of which the flattened centre is nearly as hard as basalt. Neither olivine nor amphibole can be distinguished. Before it shews itself as a separate stratum, rising in small conic hills, the amygdaloid seems to alternate by layers with the diorite, which we have mentioned above as mixed with carburetted slate and amphibolic serpentine. These close relations of rocks so different in appearance, and so likely to embarass the observer, give great interest to the vicinity of Ortiz. If the masses of diorite and amygdaloid, which appear to us to be layers, are very large veins, they may be supposed to have been formed and upheaved simultaneously. We are now acquainted with two formations of amygdaloid; one, the most common, is subordinate to the basalt: the other, much more rare,* belongs to the pyroxenic porphyry. $\dagger$ The amygdaloid of Ortiz approaches, by its oryctognostic characters, to the former of those formations, and we are almost surprised to find it joining, not basalt, but phonolite, $\ddagger$ an eminently felspathic rock, in which we find some crystals of amphibole, but pyroxene very rarely, and never any olivine. The Cerro de Flores is a hill covered with tabulary blocks of greenish grey phonolite, enclosing long crystals (not fendillated) of vitreous felspar, altogether analogous to the phonolite of Mittelgebirge. It is surrounded by pyroxenic amygdaloid; it would no doubt be seen below, issuing immediately from gneiss-granite, like the phonolite of

[^499]Biliner Stein, in Bohemia, which contains fragments of gneiss embedded in its mass.

Does there exist in South Ameriea another group of rocks, which may be preferably designated by the name of volcanic rocks, and which are as distinct from the chain of the Andes, and advance as far towards the east, as the group that bounds the steppes of Calabozo? Of this I doubt, at least in that part of the continent situated north of the Amazon. I have often directed attention to the absence of pyroxenic porphyry, trachyte, basalt, and lavas, (I range these formations according to their relative are,) in the whole of America eastward of the Cordilleras. The existence even of trachyte has not yet been verified in the Sierra Nevada de Merida, which links the Andes the littoral chain of Venezuela. It would seem as if volcanic fire, after the formation of primitive rocks, could not pierce into eastern America. Possibly the scarcity of argentiferous veins observed in those countries may be owing to the absence of more recent volcanic phenomena. $M$. Eschwege saw at Brazil some layers (veins?) of diorite, but neither trachyte, basalt, dolerite, nor amygdaloid; and he was therefore much surprised to see, in the vicinity of Rio Janeiro, an insulated mass of phonolite, exactly similar to that of Bohemia, piercing through gneiss. I am inclined to believe that America, on the east of the Andes, would have burning volcanos, if, near the shore of Venezuela, Guiana, and Brazil, the series of primitive rocks were broken by trachytes, for these, by their fendillation and open crevices, seem to establish that permanent communication between the surface of the soil and the interior of the globe, which is the indispensible condition of the existence of a volcano. If we direct our course from the coast of Paria, by the gneiss-granite of the Silla of Caracas, the red sandstone of Barquisimeto and Tocuyo, the slaty mountains of the Sierra Nevada de Merida, and the eastern Cordillera of Cundinamarca, to Popayan and Pasto, taking the direction of west-south-west, we find in the vicinity of those towns the first volcanic vents of the Andes still burning, those which are the most northerly of all South America; and it may be remarked that those craters are found where the Cordilleras begin to present
trachytes, at a distance of eighteen or twenty-five leagues from the present coast of the Pacific Ocean.* Permanent communications, or at least communications frequently renewed, between the atmosphere and the interior of the globe, have been preserved only along that immense crevice on which the Cordilleras have been upheaved; but subterranean volcanic forces are not less active in eastern America, shaking the soil of the littoral Cordillera of Venezuela, and of the Parime group. In describing the phenomena which accompanied the great earthquake of Caracas, $\dagger$ on the 26th March, 1812, I mentioned the detonations heard at different periods, in the mountains (altogether granitic) of the Orinoco. The elastic forces which agitate the ground, the still-burning volcanos, the hot sulphurous springs, sometimes containing fluoric acid, the presence of asphaltum and naphtha in primitive strata, all point to the interior of our planet, the high temperature of which is perceived even in mines of little depth, and which, from the times of Heraclitus of Ephesus, and Anaxagoras of Clazomenæ, to the Plutonic theory of modern days, has been considered as the seat of all great disturbances of the globe.

The sketch I have just traced contains all the formations known in that part of Europe which has served as the type of positive geology. It is the fruit of sixteen months' labour, often interrupted by other occupations. Formations of quartzose porphyry, pyroxenic porphyry and trachyte, of grauwacke, muschelkalk, and quadersand-

[^500]stein, which are frequent towards the west, have not yet been seen in Venezuela; but it may be also observed that in the system of secondary rocks of the old continent, muschelkalk and quadersandstein are not always clearly developed, and are often, by the frequency of their marls, confounded with the lower layers of Jura limestone. The muschelkalk is almost a lias with encrinites; and quadersandstein (for there are doubtless many above the lias or limestone with gryphites) seems to me to represent the arenaceous layers of the lower shelves of Jura limestone.

I have thought it right to give at some length this geologic description of South America, not only on account of the novel interest which the study of the formations in the equinoctial regions is calculated to excite, but also on account of the honourable efforts which have recently been made in Europe to verify and extend the working of the mines in the Cordilleras of Columbia, Mexico, Chile, and Buenos Ayres. Vast sums of money have been invested for the attainment of this useful end. In proportion as public confidence has enlarged and consolidated those enterprises, from which both continents may derive solid advantage, it becomes the duty of persons who have acquired a local knowledge of these countries to publish information calculated to create a just appreciation of the relative wealth and position of the mines in different parts of Spanish America. The success of a company for the working of mines, and that of works undertaken by the order of free governments, is far from depending solely on the improvement of the machines employed for draining off the water, and extracting the mineral, on the regular and economical distribution of the subterraneous works, or the improvements in preparation, amalgamation, and melting: success depends also on a thorough knowledge of the different superposed strata. The practice of the science of mining is closely linked with the progress of geology; and it would be easy to prove that many millions of piastres have been rashly expended in South America, from complete ignorance of the nature of the formations, and the position of the rocks, in directing
the preliminary researches. At the present time it is not precious metals solely which should fix the attention of new mining companies; the multiplication of steam-engines renders it indispensable, wherever wood is not abundant or easy of transport, to seek at the same time to discover coal and lignites. In this point of view, the precise knowledge of the red sandstone, coal-sandstone, quadersandstein, and molassus (tertiary formation of lignites), often covered with basalt and dolerite, is of great practical importance. It is difficult for a European miner, recently arrived, to judge of a country presenting so novel an aspect, and when the same formations cover an immense extent. I hope that the present work, as well as my Political Essay on New Spain, and my work on the Position of Rocks in the Two Hemispheres, will contribute to diminish those obstacles. They may be said to contain the earliest geologic information respecting places whose subterraneous wealth attracts the attention of commercial nations; and they will assist in the classification of the more precise notions which later researches may add to my labours.

The republic of Colombia, in its present limits, furnishes a vast field for the enterprizing spirit of the miner. Gold, platinum, silver, mercury, copper, gem-salt, sulphur, and alum, may become objects of important workings. The production of gold alone amounted, before the outbreak of the political dissensions, on the average, to 4700 kilogrammes ( 20,500 marks of Castile) per annum. This is nearly half the quantity furnished by all Spanish America, a quantity which has an influence the more powerful on the variable proportions between the value of gold and silver, as the extraction of the former metal has diminished at Brazil, for forty years past, with surprising rapidity. The quint (a tax which the government raises on gold-washings), and which in the Capitania of Minas Geraes, was, in 1756, 1761, and 1767, from 118, 102, and 85 arobas of gold (of $14 \frac{3}{5}$ kilogrammes), has fallen, during 1800,1813 , and 1818 , to 30,20 , and 9 arobas ; an arob of gold having, at Rio Janeiro, the value of 15,000 cruzados. According to these estimates, the produce of gold in Brazil, making deductions for fraudulent exportaation, was, in the middle of the eighteenth century, the years of the greatest prosperity of the gold-washings, 6600
kilogrammes, and in our days, from 1817 to 1820, 600 kilogrammes less. In the province of San Paulo the extraction of gold has entirely ceased; in'the province of Goyaz, it was 803 kilogrammes in 1793, and in 1819 scarcely 75. In the province of Mato Grosso it is almost nothing; and M. Eschwege is of opinion that the whole produce of gold in Brazil does not amount at present to more than 600,000 cruzados (scarcely 440 kilogrammes). I dwell on these particulars, because, in confounding the different periods of the riches and poverty of the gold-washings of Brazil, it is still affirmed in works treating of the commerce of the precions metals, that a quantity of gold equivalent to four millions of piastres ( 5800 kilogrammes of gold*) flows into Europe annually, from Portuguese America. If, in commercial value, gold in grains prevails, in the republic of Columbia, over the value of other metals, the latter are not on that account less worthy to fix the attention of government and of individuals. The argentiferous mines of Santa Anna, Manta, Santo Christo de las Laxas, Pamplona, Sapo, and La

[^501]Vega de Sapia, afford great hope. The facility of the communications between the coast of Columbia and that of Europe, imparts the same interest to the copper-mines of Venezuela and New Grenada. Metals are a merchandize purchased at the price of labour, and an advance of capital; thus forming in the countries where they are produced, a portion of commercial wealth; while their extraction gives an impetus to industry in the most barren and mountainous districts.

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THE END.


[^0]:    * Mungo Park.

[^1]:    * Some of the ancient geographers believed that the Mediterranean, swelled by the waters of the Euxine, the Palus Mæotis, the Caspian Sea, and the Sea of Aral, had broken the pillars of Hercules; others admitted that the irruption was made by the waters of the ocean. In the first of these hypotheses, the height of the land between the Black Sea and the Baltic, and between the ports of Cette and Bordeaux, determine the limit which the accumulation of the waters may have reached before the junction of the Black Sea, the Mediterranean, and the Atlantic, as well to the north of the Dardanelles, as to the east of this strip of land which formerly joined Europe to Mauritania, and of which, in the time of Strabo, certain vestiges remained in the Islands of Juno and the Moon.

[^2]:    * The limits of the trade winds were, for the first time, determined by Uampier in 1666.

[^3]:    *These camels, which serve for labour, and sometimes for food, did not exist till the Béthencourts made the conquest of the Canaries. In the sixteenth century, asses were 80 abundant in the island of Forteventura, that they became wild and were hunted. Several thousands were killed to save the harvest. The horses of Forteventura are of singular beauty, and of the Barbary race.-" Noticias de la Historia General de las Islas Canarias," por Don José de Viera, tom. 2, p. 436.

[^4]:    * I must here observe, that this rock is noted on the celebrated Venetian chart of Andrea Bianco, but that the name of Infierno is given, as in the more ancient chart of Picigano, made in 1367, to Teneriffe, without

[^5]:    * The height of this peak of the Azores, according to Fleurieu, is 1,100 toises; to Ferrer, 1,238 toises; and to Tofino, 1,260 toises : but these measures are only approximative estimates. The captain of the Pizarro, Don Manuel Cagigal, proved to me, by his journal, that he observed the peak of the Azores at the distance of 37 leagues, when he was sure of his latitude within two minutes. The volcano was seen at $4^{\circ} \mathrm{S}$. E., so that the error in longitude must have an almost imperceptible influence in the estimation of the distance. Nevertheless, the angle which the peak of the Azores subtended was so great, that the captain of the Pizurro was of opinion this volcano must be visible at more than 40 or 42 leagues. The distance of 37 leagues supposes an elevation of 1,431 toises.

[^6]:    *The oblique distances from the top of the volcano to Orotava and to Santa Cruz are nearly 8,600 toises and 22,500 toises.

[^7]:    * Without entering here into any discussion respecting the existence of the Atlantis, I may cite the opinion of Diodorus Siculus, according to whom the Atlantides were ignorant of the use of corn, because they were separated from the rest of mankind before these gramina were cultivated.

[^8]:    * The mulberries, cultivated in the thin and sandy soils of countries bordering on the Baltic Sea, are examples of this feebleness of organization. The late frosts do more injury to them, than to the mulberries of Piedmont. In Italy a cold of $5^{\circ}$ below freezing point does not destroy robust orange trees. According to M. Galesio, these trees, less tender than the lemon and bergamot orange trees, freeze only at ten centesimal degrees below freezing point.

[^9]:    * The ancient Acantejo.

[^10]:    * I speak of the species of bark-tree (cinchona), which at Peru, and in the kingdom of New Granada, flourish on the back of the Cordilleras, at the height of between 1,000 and 1,500 toises, in places where the thermometer is between nine and ten degrees during the day, and from three to four during the night. The orange bark-tree (Cinchona lancifolia) is much less delicate than the red bark-tree (C. oblongifolia).
    $\dagger$ Annona cherimolia. Lamarck.
    $\ddagger$ Puerto de la Cruz. The only fine port of the Canary Islands is that of St. Sebastian, in the isle of Gomara.

[^11]:    - This last-named village stands at the foot of the lofty mountain of Tygayga.

[^12]:    * Basaltartiger Mandelstein. Werner. $\dagger$ Bimstein-Conglomerat. W.

[^13]:    * It is the same with the plane-tree (Platanus occidentalis) which M. Michaux measured at Marietta, on the banks of the Ohio, and which, at twenty feet from the ground, was $15 \cdot 7$ feet in diameter.-" Voyage à l'Ouest des Monts Alleghany,' 1804, p. 93. The yew, chesnut, oak, plane-tree, deciduous cypress, bombax, mimosa, cæsalpinia, hymenæa, and dracæna, appear to me to be the plants which, in different climates, present specimens of the most extraordinary growth. An oak, discovered together with some Gallic helmets in 1809, in the turf pits of the department of the Somme, near the village of Yseux, seven leagues from Abbeville, was about the same size as the dragon-tree of Orotava. According to a memoir by M. Traullée, the trunk of this oak was 14 feet in diameter.

[^14]:    * The form of the dragon-tree is exhibited in several species of the genus Dracæna, at the Cape of Good Hope, in China, and in New Zealand. But in New Zealand it is superseded by the form of the yucca; for the Dracsena borealis of Aiton is a Convallaria, of which it has all the appearance. The astringent juice, known in commerce by the name of dragon's blood, is, according to the inquiries we made on the spot, the produce of several American plants, which do not belong to the same genus, and of which some are lianas. At Laguna, toothpicks steeped in the juice of the dragon-tree are made in the nunneries, and are much extolled as highly useful for keeping the gums in a healthy state.

[^15]:    * "Phil. Trans.," vol. xxix, p. 317. Carabela is the name of a vessel with lateen sails. The pines of the peak formerly were used as masts of vessels.

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[^16]:    * This denomination was in use as early as the beginning of the last century. Mr. Eden, who corrupts all Spanish words, as do most travellers in our own times, calls it the Stancha: it is the Station des Rochers of M. Borda, as is proved by the barometrical heights there observed.

[^17]:    These heights were in 1803, according to M. Cordier, 19 inches 9.5 lines ; and in 1776, according to Messrs. Borda and Varela, 19 inches 9.8 lines; the barometer at Orotava keeping within nearly a line at the same height.

[^18]:    * A celebrated astronomer, Baron Zach, has compared this phenomenon of an apparent libration of the stars to that described in the Georgics (lib. 1, v. 365). But this passage relates only to the falling stars, which the ancients, (like the mariners of modern times) considered as a prognostic of wind.

[^19]:    *This question has been examined with much sagacity by M. Brieslak, in his "Introduzzione alla Geologia," t. ii., p. 302, 323, 347. Cotopaxi and Popocatepetl, which I saw ejecting smoke and ashes, in 1804, are farther from both the Pacific and the Gulf of the Antilles, than Grenoble is from the Mediterranean, and Orleans from the Atlantic. We must not consider the fact as merely accidental, that we have not yet discovered an active volcano more than 40 leagues distant from the ocean; but I consider the hypothesis, that the waters of the sea are absorbed, distilled, and decomposed by volcanoes, as very doubtful.

[^20]:    - The great volcanoes of Cotopaxi and Rucupichincha have craters, the diameters of which, according to my measurements, exceed 400 and 700 toises.

[^21]:    * Opalartiger kieselsinter. The siliceous gurh of the volcanoes of the Isle of France contains, according to Klaproth, 0.72 silex, and 0.21 water; and thus comes near to opal, which Karsten considers as a hydrated silec.

[^22]:    * During the stay of M. Gay-Lussac and myself at the hospice of Mont Cenis, in March 1805, we collected air in the midst of a cloud loaded with electricity. This air, analysed in Volta's eudiometer, contained no hydrogen, and its purity did not differ $0 \cdot 002$ of oxygen from the air of Paris, which we bad carried with us in phials hermetically cealed.

[^23]:    - Fringilla Canaria. La Caille relates, in the narrative of his voyage to the Cape, that on Salvage Island these canaries are so abundant, that you cannot walk there in a certain season without breaking their eggs.

[^24]:    *The word Echeyde, which signifies Hell in the language of the Guanches, has been corrupted by the Europeans into Teyde.

    + Two volcanoes of the Provinces of Quixns and Mechoacan, the one in the southern, and the other in the northern hemisphere.

[^25]:    * Gilbert, Annalen der Physik, B. 5, p. 455. Vesuvius is 133,000 palmas, or eighteen nautical miles in circumference. The horizontal distance from Resina to the crater is 3,700 toises. Italian mineralogists have estimated the circumference of Etna at 840,000 palmas, or 119 miles. With these data, the ratio of the height to the circumference would be only a seventy-second; but I find on tracing a curve through Catania, Palermo, Bronte, and Piemonte, only 62 miles in circumference. according to the best maps. This increases the ratio to a fifty-fourth. Does the basis fall on the outside of the curve that I assume?

[^26]:    * I have measured the summit of Pichincha, that is the small mountain covered with ashes above the Llano del Vulcan, to the north of Alto de Chuquira. This mountain has not, however, the regular form of a cone. As to Vesuvius, I have indicated the mean height of the Sugar-loaf, on account of the great difference between the two edges of the crater.

[^27]:    * The trap-formation includes the basalts, green-stone (grunsteis), the trappean porphyries, the phonolites or porphyrschiefer, \&c.
    $\dagger$ These petrosiliceous masses contain vitreous and often calcined crystals of feldspar, of amphibole, of pyroxene, a little of olivine, but scarcely any quartz. To this very ambiguous formation belong the trappean porphyries of Chimborazo and of Riobamba in America, of the Duganean mountains in Italy, and of the Siebengebirge in Germany ; as well as the domites of the Great-Sarcouy, of Puy-de-Dôme, of the Little Cleirsou, and of one part of the Puy-Chopine in Auvergne.

[^28]:    - The name crystalites has been given to the crystalized thin plates observed in glass cooling slowly. The term glastenized glass is employed by Dr. Thompson and others to indicate glass which by slow cooling is wholly unvitrified, and has assumed the appearance of a fossil sub. stance, or real glass-stone.

[^29]:    * In the valuable collection of Dr. Thomson, who resided at Naples till 1805, is a fragment of lava enclosing a real granite, which is composed of reddish feldspar with a pearly lustre like adularia, quartz, mica, hornblende, and, what is very remarkable, lazulite. But in general the masses of known primitive rocks, (I mean those which perfectly resemble our granites, our gneiss, and our mica-slates) are very rare in lavas; the substances we commonly denote by the name of granite, thrown out by Vesuvius, are mixtures of nepheline, mica, and pyroxene. We are ignorant whether these mixtures constitute rocks sui generis placed under granite, and consequently of more ancient date; or simply form either intermediate strata or veins, in the interior of the primitive mountains, the tops of which appear at the surface of the globe.

[^30]:    * This extraordinary fact was first observed by M. Swarz. It was confirmed by M. Willdenouw when he careful examined our herbals, especially the collection of cryptogamous plants, which we gathered on the tops of the Andes, in a region of the world where organic life is totally different from that of the old world.
    $\dagger$ The pores corticaux of M. Decandolle, discovered by Gleichen, and figured by Hedwig.

[^31]:    * Laurus indica, L. foetens, L. nobilis, and L. Til. With these trees are mingled the Ardisia excelsa, Rhamnus glandulosus, Erica arborea, and E. texo.
    $\dagger$ Quercus canariensis, Broussonnet.

[^32]:    * Woodwardia radicans, Asplenium palmatum, A. canariensis, A. latifolium, Nothalæna subcordata, Trichomanes canariensis, T. speciosum, and Davallia canariensis.
    $\dagger$ Two Acrostichums and the Ophyoglossum lusitanicum.
    $\ddagger$ Hypericum canariense, H. floribundum, and H. glandulosum.
    § Pinus halepensis. M. Decandolle observes, that this species, which is not found in Portugal, but grows on the Mediterranean shores of France, Spain, and Italy, in Asia Minor, and in Barbary, would be better named Pinus mediterranea. It composes the principal part of the pine-forests of the south-east of France, where Gouan and Gerard have confounded it with the Pinus sylvestris. It comprehends the Pinus halepensis, Mill., Lamb., and Desfont., and the Pinus maritima, Lamb.

[^33]:    * The Spanish historians speak of expeditions made by the Huguenots of Rochelle to carry off Guanche slaves. I have some doubt respecting these expeditions, which are said to have taken place subsequently to the year 1530 .

[^34]:    * It has been long imagined, that the language of the Guanches had no analogy with the living tongues; but since the travels of Hornemann, and the ingenious researches of Marsden and Venturi, have drawn the attention of the learned to the Berbers, who, like the Sarmatic tribes, occupy an immense extent of country in the north of Africa, we find that several Guanche words have comnon roots with words of the Chilha and Gebali dialects. We shall cite, for instance, the words :
    

    I doubt whether this analogy is a proof of a common origin ; but it is an indication of the ancient connexion between the Guanches and Berbers, a tribe of mountaineers, in which the ancient Numidians, Getuli, and Garamanti are confounded, and who extend themselves from the eastern extremity of Atlas by Harutsh and Fezzan, as far as the oasis of Siwah and Augela. The natives of the Canary Islands called themselves Guanches, from guan, man; as the Tonguese call themselves bye, and tongui, which have the same signification as guan. Besides, the nations

[^35]:    who speak the Berberic language are not all of the same race; and the description which Scylax gives, in his Periplus, of the inhabitants of Cerne, a shepherd people of tall stature and long hair, reminds us of the features which characterize the Canarian Guanches.

[^36]:    * In the Atlantic Ocean there is a space where the water is constantly milky, though the sea is very deep. This curious phenomenon exists in the parallel of the island of Dominica, very near the 57 th degree of longitude. May there not be in this place some sunken volcanic islet, more easterly still than Barbadoes ?

[^37]:    * Heliconia bihai.

[^38]:    * A brown pelican, of the size of a swan. (Pelicanus fuscus, $L_{i j n}$ )

[^39]:    * A retail dealer.

[^40]:    *Tuna macho. We distinguish in the wood of the cactus the medul. lary prolongations, as M. Desfontaines has already observed.

[^41]:    *The real cause of the mirage, or the extraordinary refraction which the rays undergo when strata of air of different densities lie over each other, was guessed at by Hooke.-See his Posthumous Works, p. 472.

[^42]:    - This classification dates from the time of Posidonius. It is the swecessio and inctinatio of Seneca; but the ancients had adready judiciously remarked, that the nature of these shocks is too variable to permit any subjection to these imaginary laws.
    t The Guayquerias of La Banda del Norte consider themselves as the most noble race, because they think they are less mixed with the Chayma Indian, and other copper-coloured races. They are distinguished from the Guayquerias of the continent by their manner of pronouncing the Spanish language, which they speak almost without separating their teeth. They show with pride to Europeans the Punta de la Galera, or Galley's Point, .

[^43]:    - The Spaniards designate by the name of dormideras (sleeping plants), the small number of mimosas with irritable leaves. We have incressed this number by three species previously unknown to botanists, namely, the Mimosa humilis of Cumana, the M. pellita of the savannahs of Calabozo, and the M. dormiens of the banks of the Apure.
    + These calabashes are made from the fruit of the Crescentia cujete.

[^44]:    - Cavia capybara, Lin.; chiguire.
    + Vultur aura, Lin., Zamuro, or Galinazo: the Brazilian vulture of Buffon. I cannot reconcile myself to the adoption of names, which designate, as belonging to a single country, animals common to a whole continent.
    $\ddagger$ Scolopendras are very common behind the castle of San Antonio, on the sammit of the hill.

[^45]:    * The Blue Mountains of Australia, and those of Carmarthen and Lansdowne, are not visible, in clear weather, beyond fifty miles.-Péron, Voyage aux Terres Australes, page 389. Supposing the angle of altitude half a degree, the absolute height of these mountains would be about 620 toises.
    + Chacra, by corruption chara, signifies a hut or cottage surrounded by a garden. The word ipure has the same signification.
    $\ddagger$ The common machi, or weeping monkey.
    § Chihuchihue, of the family of the ananas.

[^46]:    Benzoni, Hist. del Mondo Nuovo, pp. 3, 31, and 33. James Castellon arrived at St. Domingo in 1521, after the appearance of the celebrated Bartholomew de las Casas in these countries. On attentively reading the narratives of Benzoni and Caulin, we find that the fort of Castellon was built near the mouth of the Manzanares (alla ripa del fiume de Cumana); and not, as some modern travellers have asserted, on the mountain where now stands the castle of San Antonio.

[^47]:    * "Mercy! the earthquake! the earthquake!"-See Tschudi's Travels in Peru, p. 170.

[^48]:    * When at Cumana, or in the island of Margareta, the people pronounce the words el tirano (the tyrant), it is always to denote the hated Lopez d'Aguirre, who, after having taken part, in 1560, in the revolt of Fernando de Guzman against Pedro de Ursua, governor of the Omeguas and Dorado, voluntarily took the title of traidor, or traitor. He descended the river Amazon with his band, and reached by a communication of the rivers of Guyana the island of Margareta. The port of Paraguache still bears, in this island, the name of the Tyrant's Port.

[^49]:    * " In puteis est remedium, quale et crebri specus prebent : conceptum enim spiritum exhalant : quod in certis notatur oppidis, quæ minus quatiuntur, cxebris ad cluviem cuniculis cavata."-Pliny, lib. ii, c. 82 (ed. Par. 1723, t. i., p. 112.) Even at present, in the capital of St. Domingo, wells are considered as diminishing the violence of the shocks. I may observe on this occasion, that the theory of earthquakes, given by Seneca, (Nat. Quæst., lib. vi., c. 4-31), contains the germ of everything that has been said in our times on the action of the elastic vapours confined in the interior of the globe.

[^50]:    * The Llanos of Cumana, of New Barcelona, of Calabozo, of Apure, and of Meta.
    $\dagger$ The lst of November, 1755, and 31st of March, 1761. During the first of these earthquakes, the sea inundated, in Europe, the coasts of Sweden, England, and Spain; in America, the islands of Antigua, Barbadoes, and Martinique. At Barbadoes, where the ordinary tides rise only from twenty-four to twenty-eight inches, the water rose twenty feet in Carlisle Bay. It became at the same time as black as ink; being, without doubt, mixed with the petroleum, or asphaltum, which abounds at the bottom of the sea, as well on the coasts of the gulf of Cariaco, as

[^51]:    * "The shocks ceased only when a crevice, which ejected a river of fiery mud, opened in the plain of Lelantum, near Chalcis."--Strabo.

[^52]:    * Elater noctilucus. + Lampyris italica, L. noctiluca.

[^53]:    * "What an icy cold! I shiver as if I was on the top of the mountains." The provincial word emparamarse can be translated only by a very long periphrasis. Paramo, in Peruvian puna, is a denomination found on all the maps of Spanish America. In the colonies it signifies neither a desert nor a heath, but a mountainous place covered with stunted trees, exposed to the winds, and in which a damp cold perpetually reigns. In the torrid zone, the paramos are generally from one thousand six hundred to two thousand toises high. Snow often falls on them, but it remains only a few hours; for we must not confound, as geographers often do, the words paramo and puna with that of nevado, in Peruvian ritticapa, a mountain which enters into the limits of perpetual snow. These notions are highly interesting to geology and the geography of plants; because, in countries where no height has been measured, we may form an exact idea of the lowest height to. which the Cordilleras rise, on looking into the map for the words paramo and nevado. As the paramos are almost continually enveloped in a cold and thick fog, the people say at Santa Fé and at Mexico, cae un paramito,

[^54]:    when a thick small rain falls, and the temperature of the air sinks considerably. From paramo has been made emparamarse, which signifies to be as cold as if we were on the ridge of the Andes.

[^55]:    - In this narrative, as well as in the Political Essay on New Spain, all the prices are reckoned in piastres, and silver reals (reales de plata). Eight of these reals are equivalent to a piastre, or one hundred and five sous, French money (48. $4 \frac{1}{1} d$. English). Nouv. Esp., vol. ii., p. 519, 616, and 866.
    $\dagger$ The fanega of salt is sold to those Indians and fishermen who do not pay the duties (derechos reales), at Punta Araya for six, at Cumana for eight reals. The prices to the other tribes are, at Araya ten, at Cumana twelve reals.

[^56]:    - Alpenkalkstein.
    $\dagger$ Sandsteinschiefer. $\ddagger$ Thonschiefer. § Dichter kalkstein.
    I| It were to be wished that mineralogical travellers would examine more particularly the Cerro de la Vela. The limestone of the Peñas Negras

[^57]:    * Uebergangstyps, in the transition slate of White Alley (l'Allée Blanche), and between the grauwacke and black transition timestone near Bex, below the Dent de Chamossaire, according to M. von Buch.
    $\dagger$ At Halle in the Tyrol.

[^58]:    * 'Por alla,' or, 'del otro lado del charco,' (properly 'beyond,' or 'on the other side of the great lake'), a figurative expression, by which the people in the Spanish colonies denote Europe.

[^59]:    - The cutting of diamonds was invented by Lewis de Berquen, in 1456, but the art became common only in the following century.
    + I am astonished at never having heard, in the course of my travels, of pearls found in the fresh-water shells of South America, though several species of the Unio genus abound in the rivers of Peru.

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[^60]:    *The inhabitants of Araya sometimes sell these small pearls to the retail dealers of Cumana. The ordinary price is one piastre per dozen.
    $\dagger$ On the map accompanying Robertson's History of America, we find the name of this castle confounded with that of Nueva Cordoba.

[^61]:    * As at Pietra Mala; Fanano; Mont Zibio; and Amiano (in these places are found the springs that furnish the naphtha burned in lamps in Genoa); and also at Baikal.

[^62]:    * These caper-trees are called in the country, by the names pachaca, olivo, and ajito : they are the Capparis tenuisiliqua, Jacq., C. ferruginea, C. emarginata, C. elliptica, C. reticulata, C. racemosa.
    + Palo sano, Zygophyllum arboreum, Jacq. The flowers have the smell of vanilla. It is cultivated in the gardens of the Havannah under the strange name of the dictanno real (royal dittany).

[^63]:    - The magnetic dip is always measured in this work, according to the centesimal division, if the contrary be not expressly mentioned.
    + At the summit of the boughs, the leaves are sometimes opposite to each other, but invariably without stipules.

[^64]:    * Cornus florida, and C. sericea of the United States.-Walker on the Virtues of the Cornus and the Cinchona compared. Philadelphia, 1803.

[^65]:    * It may be somewhat interesting to chemistry, physiology, and descriptive botany, to consider under the same point of view the plants which have been employed in intermittent fevers with different degrees of success. We find among rubiaceous plants, besides the cinchonas and exostemas, the Coutarea speciosa or Cayenne bark, the Portlandia grandiflora of the West Indies, another portlandia discovered by M. Sesse at Mexico, the Pinkneia pubescens of the United States, the berry of the coffee-tree, and perhaps the Macrocnemum corymbosum, and the Guettarda coccinea; among magnoliaceous plants, the tulip-tree and the Magnolia glauca; among zanfhoxylaceous plants, the Cuspare of Angostura, known in America under the name of Orinoco bark, and the Zanthoxylon caribæum ; among leguminous plants, the geoffræas, the Swietenia febrifuga, the Æschynomene grandiflora, the Cæsalpinea bonducella; among caprifoliaceous plants, the Cornus florida and the Cuspa of Cumana; among rosaceous plants, the Cerasus virginiana and the Geam urbanum ; among amentaceous plants, the willows, oaks, and birch-trees, of which the alcoholic tincture is used in Russia by the common people; the Populus tremuloides, \&cc. ; among anonaceous plants, the Uvaria febrifuga, the fruit of which we saw administered with success in the Missions of Spanish Guiana; among simarubaceous plants, the Quassia amara, celebrated in the feverish plains of Surinam; among terebinthaceous plants, the Rhus glabrum ; among euphorbiaceous plants, the Croton cascarilla; among composite plants, the Eupatorium perfoliatum, the febrifuge qualities of which are known to the savages of North America. Of the tulip-tree and the quassia, it is the bark of the roots that is used. Eminent febrifuge virtue have also been found in the cortical part of the roots of the Cinchona condaminea at Loxa; but it is fortunate, for the preservation of the species,

[^66]:    that the roots of the real cinchona are not employed in pharmacy. Chemical researches are yet wanting upon the very powerful bitters contained in the roots of the Zanthoriza apiifolia, and the Actaa racemosa: the latter have sometimes been employed with success as a remedy against the epidemic yellow fever in New York.

    * In French, " l'amer et le rouge cinchoniques."
    † The cuspare bark (Cort. Angosture) yields with iron a yellow precipitate ; yet it is employed on the banks of the Orinoco, and particularly at the town of St. Thomas of Angostura, as an excellent cinchona; and. on the other hand, the bark of the common cherry tree, which has

[^67]:    * Bambusa guadua.
    + Arundo donaz.

[^68]:    * A certain number of habitations collected round a church, with a missionary monk performing the ministerial duties, is called in the Spanish colonies Mision, or Pueblo de mision. Indian villages, governed by a priest, are called Pueblos de doctrina. A distinction is made between the Cura doctrinero, who is the priest of an Indian parish, and the Cura rector, priest of a village inhabited by whites and men of mixed race.

[^69]:    * These trees are surrounded by Galega pilosa, Stellaria rotundifolia, Aegiphila elata of Swartz, Sauvagesia erecta, Martinia perennis, and a great number of Rivinas. We find among the gramineous plants, in the savanna of Cumanacoa, the Paspalus lenticularis, Panicum ascendens, Pennisetum uniflorum, Gynerium saccharoïdes, Eleusine indica, \&c.
    † "Estanco real de tabaco," royal monopoly of tobacco.

[^70]:    * The indigo known in commerce is produced by four species of plante; the Indigofera tinctoria, I. anil, I. argentea, and I. disperma. At the Riu Negro, near the frontiers of Brazil, we found the I. argentea growing wild, but only in places anciently inhabited by Indians.

[^71]:    * The planters are pretty generally of opinion, that the fermentation should never continue less than ten hours.-Beauvais-Raseau, "Art de l'Indigotier,' p. 81.

[^72]:    - Gossypium uniglandulosum, improperly cailed herbaceum, and G. barbadense.
    $\dagger$ G. religiosum. $\ddagger$ Bombax Ceiba : five-leaved silk-cotton tree.
    || Great knives, with very long blades, like a couteau de chasse. No one enters the woods in the torrid zone without being armed with a machete, not only to cut his way through the woods. but as a defence against wild beasts.
    \& Felis onca, Lin., which Buffon called panthère oillee, and which he believed came from Africa.

    If Felis pardalis, Lin., or the chibiguazu of Azara, different from the Tlateo-Ocelotl, or tiger-cat of the Aztecs.

[^73]:    * Brownea racemosa.
    - Plants of families entirely different are called in the Spanish colonies of both continents, sangre de draco ; they are dracænas, pterocarpi, and crotons. Father Caulin, (Descrip. Corografica, p. 25,) in speaking of

[^74]:    * We must not confound this very rare phenomenon with the glimmering commonly observed a few toises above the brink of a crater, and which (as I remarked at Mount Vesuvius in 1805) is only the reflection of great masses of inflamed scoria, thrown up without sufficient force to pass the mouth of the volcano.
    $\dagger$ "Albano monte biduum continenter lapidibus pluit."-Livy, lib. exv. cap. 7. (Heyne, Opuscula Acad., tom. iii. p. 261.)

[^75]:    * Is this name of Indian origin? At Cumana I heard it derived in a manner somewhat far-fetched from the Spanish word cogollo, signifying the heart of oleraceous plants. The Cocollar forms the centre of the whole group of the mountains of New Andalusia.
    $\dagger 11.2^{\circ}$ Reaum.

[^76]:    * Cassia acuta, Andromeda rigida, Casearia hypericifolia, Myrtus longifolia, Buettneria salicifolia, Glycine picta, G. pratensis, G. gibba, Oxalis umbrosa, Malpighia caripensis, Cephælis salicifolia, Stylosanthes angustifolia, Salvia pseudococcinea, Eryngium foetidum. We found a second time this last plant, but at a considerable height, in the great forests of bark trees surrounding the town of Loxa, in the centre of the Cordilleras.
    $\dagger$ Lobelia spectabilis.
    $\ddagger$ It is the Gualtheria odorata. The pejoa is found round the lake of Cocollar, which gives birth to the great river Guarapiche. We met with the same shrub at the Cuchilla de Guanaguana. It is a subalpine plant, which forms at the Silla de Caracas a zone much higher than in the province of Cumana. The leaves of the pejoa have even a more agreeable smell than those of the Myrtus pimenta, but they yield no perfume when rubbed a few hours after their separation from the tree.

[^77]:    * Melastoma xanthostachys, called guacito at Caracas.
    † Palicourea rigida, chaparro bovo. In the savannahs, or llanos, the same Castilian name is given to a tree of the family of the proteaceæ.
    $\ddagger$ For example, in the Montaña de Avila, on the road from Caracas to La Guayra, and in the Silla de Caracas. The seeds of the marica are ripe at the end of December.

[^78]:    * These ridges, which are rather difficult to climb towards the end of the rainy season, are distinguished by the names of Los Yepes and Fantasma.

[^79]:    - Is this the Laurus cinnamomoides of Mutis? What is that other cinnamon tree which the Indians call tuorco, common in the mountains of Tocayo, and at the sources of the Rio Uchere, the bark of which is mixed with chocolate ? Father Caulin gives the name of curucay to the Copaifera officinalis, which yields the Balsam of Capivi.-Hist. Corograf., pp. 24 and 34.
    + Laguna de la Brea, south-east of the port of Naparima. There is another spring of asphaltum on the eastern coast of the island, in the bay of Mayaro.
    $\ddagger$ Literally " blade of a knife." Throughout all Spanish America the name of "cuchilla" is given to the ridge of a mountain terminated on each side by very steep declivities.

[^80]:    * These natural meadows are part of the llanos or immense steppes bordered by the Orinoco. $\dagger$ El Cucurucho.
    § Drosera tenella.

[^81]:    * Among the interesting plants of the valley of Caripe, we found for the first time a calidium, the trunk of which was twenty feet high (C. arboream) ; the Mikania micrantha, which may probably possess some of the alexipharmic properties of the famous guaco of the Choco; the Banhinia obtusifolia, a very large tree, called guarapa by the Indians; the Weinmannia glabra; a tree psychotria, the capsules of which, when rubbed between the fingers, emit a very agreeable orange smell; the Dorstenia Houstoni (raiz de resfriado) ; the Martynia Craniolaria, the white fiowers of which are six or seven inches long; a scrophularia, having the aspect of the Verbascum miconi, and the leaves of which, all radical and bairy, are marked with silvery glands.

[^82]:    * The province of Guacharucu, which Delgado visited in 1534, in the expedition of Hieronimo de Ortal, appears to have been situated south or south-east of Macarapana. Has its name any connexion with those of the cavern and the bird ? or is this last of Spanish origin ? (Laet, Nova Orbis, p. 676). Guacharo means in Castilian "one who cries and laments;" now the bird of the cavern of Caripe, and the guacharaca (Phasianus parraka), are very noisy birds.

[^83]:    *The mould, which has covered for thousands of years the soil of the caverns of Gaylenreuth and Muggendorf in Franconia, emits even now choke-damps, or gaseous mixtures of hydrogen and nitrogen, which rise to the roof of the caves. This fact is known to the persons who show these caverns to travellers; and when I was director of the mines of the Fichtelberg, I observed it frequently in the summer-time. M. Laugier found in the mould of Muggendorf, besides phosphate of lime, $0 \cdot 10$ of animal matter. I was struck, during my stay at Steeben, with the ammoniacal and foetid smell produced by it, when thrown on a red-hot iron.
    † Caruto, Genipa americana. The flower, at Caripe, has sometimes five, sometimes six stamens.

[^84]:    * A dendrobium, with a gold-coloured flower, spotted with black, three inches long.
    + Solandra scandens. It is the gousaticha of the Chayma Indians.

[^85]:    * We find the phenomenen of a subterranean cascade, but on a much larger scale, in England, at Yordas Cave, near Kingsdale in Yorkshire.

[^86]:    * Opfer-erde of the cavern of Höhle Berg (or Hole Mountain, - a mountain pierced entirely through).

[^87]:    - It is surprising that Father Gili, author of the Saggio di Storia Americana, does not mention it, though he had in his possession a manusoript written in 1780 at the convent of Caripe. 1 gave the first information respecting the Cueva del Guacharo in 1800, in my letters to Messrs. Delambre and Delamétherie, published in the Journal de Physique.
    $\dagger$ Heliconia bihai, Linn. The Creoles have changed the $b$ of the Haytian word bihao into $v$, and the $h$ into $j$, agreeably to the Castilian prcnunciation.

[^88]:    * Gypsum of Bottendorf, schlottepgyps.

[^89]:    * In the night of the 16th April, 1802.

[^90]:    * At Vesuvius, the Duke de la Torre showed me, in 1805, in currents of recent lava, cavities extending in the direction of the current, six or seven feet long and three feet high. These little volcanic caverns were lined with specular iron, which cannot be called oligiste iron, since M. Gay-Lussac's last experiments on the oxides of iron.
    $\dagger$ Machay is a word of the Quichua language, commonly called by the Spaniards ' the Incas' language.' Callancamachay means "a cavern as large as a house," a cavern that serves as a tambo or caravansarai.
    $\ddagger$ Sometimes fire acts like water in carrying off masses, and thus the cavities may be caused by an igneous, though more freouently by an aqueous erosion or solution.

[^91]:    - Lichen tophicola was discovered when the beautiful cavern of Rosen. müller in Franconia was first opened. The cavity containing the lichen was found closed on all sides by enormous masses of stalactite.
    $\dagger$ That description of fetid limestone called by the German mineralogists stinkstein is always of a blackish brown colour. It is only by decomposition that it becomes white, after having acted on the surrounding air. The stinkstein which is of secondary formation, must not ie confounded with a very white primitive granular limestone of the island of Thasos, which emits, when scraped, a smell of sulphuretted hydrogen. This marble is coarser grained than Carrara (Marmor lunense). It was frequently employed by the Grecian sculptors, and I often picked up fragments of it at the Villa Adriani, near Rome.

[^92]:    * The megalonyx was found in the caverns of Green Briar, in Virginia, at the distance of 1500 leagues from the megatherium, which resembles it very much, and is of the size of the rhinoceros.
    + The famous Baumannshöhle in the Hartz, according to Messrs. Gilbert and Ilsen, is only 578 feet in length; the cavern of Scharzfeld 350 ; that of Gaylenreuth 304 ; that of Antiparos 300. But according to Saussure, the Grotto of Balme is $\mathbf{1 3 0 0}$ feet long.

[^93]:    * At Funchal (lat. $32^{\circ} 37^{\prime}$ ) the mean temperature of the air is $20.4^{\circ}$, and at Cairo (lat. $30^{\circ} 2^{\prime}$ ), according to Nouet, it is $22 \cdot 4^{\circ}$.
    +The mean temperature of the air at the Havannah, according to Mr. Ferrer, is $256^{\circ}$,

[^94]:    * The mean temperature of the month of September at Caripe is $18.5^{\circ}$; and on the coast of Cumana, where we had opportunities of making numerous observations, the mean heat of the warmest months differs only $1.8^{\circ}$ from that of the coldest.

[^95]:    * Stentor, Geoffroy.
    + Ateles, Geoffroy.

[^96]:    * In the writings of the early Spanish missionaries, this monkey is described by the names of aranata and arayuato. In both names we easily discover the same root. The $v$ has been transformed into $g$ and $n$. The name of arabata, which Gumilla gives to the howling apes of the Lower Orinoco, and which Geoffroy thinks belongs to the S. straminea of Great Paria, is the same Tamanac word aravata. This identity of names need not surprise us. The language of the Chayma Indians of Cumana is one of the numerous branches of the Tamanac language, and the lattes is connected with the Caribbee language of the Lower Orinoco. $\dagger$ Alouate ourse (Simia ursina).

[^97]:    * Polybotya.

[^98]:    * Or the Butter. Slope. Manteca in Spanish signifies butter. $\dagger$ Mountain of the Fine Prospect.

[^99]:    * The following is a list of the social plants that cover those sandy plains on the sea-side, and characterize the vegetation of Cumana and the gulf of Cariaco. Rhizophora mangle, Avicennia nitida, Gomphrena flava, G. brachiata, Sesuvium portulacastrum (vidrio), Talinum cuspidatum (vicho), T. cumanense, Portulacca pilosa (zargasso), P. lanuginosa, Illecebrum maritimum, Atriplex cristata, Heliotropium viride, H. latifolium, Verbena cuneata, Mollugo verticillata, Euphorbia maritima, Convolvulus cumanensis.

[^100]:    * In the island of Guadaloupe, there is a fountain of boiling water, which rushes out on the beach. Hot-water springs rise from the bottom of the sea in the gulf of Naples, and near the island of Palma, in the archipelago of the Canary Islands.
    $\dagger$ The cocoa-tree grows in the northern hemisphere from the equator to latitude $28^{\circ}$. Near the equator we find it from the plains to the height of $\mathbf{7 0 0}$ toises above the level of the sea.

[^101]:    - These chiefs bear the designations of Pecannati, Apoto, or Sibierne.

[^102]:    * The name of this monk, celebrated for his intrepidity, is still revered in the province. He sowed the first seeds of civilization among these mountains. He had long been captain of a ship; and before he became a monk, was known by the name of Tiburtio Redin.

[^103]:    *The early historians of the conquest state thrat the blackening of the teeth was effected by the leaves of a tree which the natives called hay, and which resembled the myrtle. Among nations very distant from each other, the pimento bears a similar name; among the Haytians aji or ahi; among the Maypures of the Orinoco, ai. Some stimulant and aromatic plants, which mostly belonging to the genus capsicum, were designated by the same name.

[^104]:    * Physiologists would never have entertained any difference of opinion respecting the existence of the beard among the Americans, if they had considered what the first historians of the Conquest have said on this subject; for example, Pigafetta, in 1519, in his journal, preserved in the Ambrosian Library at Milan, and published (in 1800) by Amoretti ; Benzoni, Hist. del Mundo Nuovo, 1572 ; Bembo, Hist. Venet., 1557.
    t Thus, in their finest statues, the Greeks exaggerated the form of the forehead, by elevating beyond proportion the facial line.

[^105]:    * Savages, to express great numbers with more facility, are in the habit of forming groups of five, ten, or twenty grains of maize, according as they reckon in their language by fives, tens, or twenties.

[^106]:    * See Vater's Mithridates.

[^107]:    * In the Greenland language, for example, the multiplicity of the pronouns governed by the verb produces twenty-seven forms for every tense of the Indicative mood. It is surprising to find, among nations now ranking in the lowest degree of civilization, this desire of graduating the relations of time, this superabundance of modifications introduced into the verb, to characterise the object. . Matarpa, he takes it away : mattarpet, thou takest it away : mattarpatit, he takes it away from thee: mattarpagit, I take away from thee. And in the preterite of the same verb, mattara, he has taken it away: mattaratit, he has taken it away from thee. This example from the Greenland language shows how the governed and the personal pronouns form one compound, in the American languages, with the root of the verb. These slight differences in the form of the verb, according to the nature of the pronouns governed by it, is found in the Old World only in the Biscayan and Congo languages (Vater, Mithridates. William von Humboldt, On the Basque Language). Strange conformity in the structure of languages on spots so distant, and among three races of men so different,-the white Catalonians, the black Congos, and the copper-coloured Americans!

[^108]:    * The termites, so well known in Spanish America under the name of comegen, or 'devourer,' is one of these destructive insects.

[^109]:    * In Chayma: utechire, 'I will go also,' properly I (u) to go (the radical ute, or, because of the preceding vowel, te) also (chese, or ere, or ire). In utechire we find the Tamanac verb 'to go,' uteri, of which ute is also the radical, and ri the termination of the Infinitive. In order to show that in Chayma chere or ere indicates the adverb 'also,' I shall cite from the fragment of a vocabulary in my possession, $u$-chere, ' I also ;' nacaramayre, ' he said so also;' guarzazere, 'I carried also ;' charechere, 'to carry also.' In the Tamanac, as in the Chayma, chareri signifies 'to carry.'
    $\dagger$ The present in the Tamanac, jarer-bac-ure, appears to me nothing else than the verb bac, or uac (from uacschiri, 'to be'), added to the

[^110]:    - In the Quichua, or language of the Incas, the sun is inti; love, munay; great, veypul; in Sanscrit, the sun, indre; love, manya; great, vipulo. (Vater, Mithridates, tom. iii. p. 333.) These are the only examples of analogy of sound, that have yet been noticed. The grammatical character of the two languages is totally differert.
    + Vinay, 'always,' or 'eternal ;' huayna, 'in the flower of age.'
    $\ddagger$ For example, the substitution of $r$ for $l$, characterizes the Bashmuric dialect of the Coptic language.

[^111]:    * Whence the German bruder, with the same consonants.
    + Even in the Sanscrit several tenses are formed by aggregation; for example, in the first future, the substantive verb 'to be' is added to the radical. In a similar manner we find in the Greek mach-eso, if the st be not the effect of inflexion, and in Latin pot-ero (Bopp, p. 26 and 66). These are examples of incorporation and agglutination in the gramY 2

[^112]:    * See, on the incontestible identity of the ancient Egyptian and Coptic, and on the particular system of eynthesis of the latter language, the in-

[^113]:    * M. Kunth has combined together three genera of the palms, Calamus, Sigus, and Mauritia, in a new section, the Calamex. $\dagger$ Agave Americana, the aloe of our gardens.

[^114]:    * If the name of the port Pam-patar, in the island of Margareta, be Guaiquerean, as we have no reason to doubt, it exhibits a feature of analogy with the Cumanagoto tongue, which approaches the Caribbean and Tamanac. In Terra Firma, in the Piritu Missions, we find the village of Cayguapatar, which signifies house of Caygua.
    † Are the Guaiqueries, or O-aikeries, now settled on the borders of the Erevato, and formerly between the Rio Caura and the Cuchivero, near the little town of Alta Gracia, of a different origin from the Guaikeries of Cumana? I know also, in the interior of the country, in the Missions of the Piritus, near the village of San Juan Evangelista del Guarive, a ravine very anciently called Guayquiricuar. These resemblances seem to prove migrations from the south-west towards the coast. The termination cuar, found so often in Cumanagoto and Caribbean names, means a ravine, as in Guaymacuar (ravine of lizards), Pirichucuar (a ravine overshaded by pirichu or piritu palm-trees), Chiguatacuar (a ravine of land-shells). Raleigh describes the Guaiqueries under the name of Ouikeries. He calls the Chaymas, Saimas, changing (according to the Caribbean pronunciation) the ch into $s$.

[^115]:    * Vater, tom. iii. pt. ii., p. 364. The name of Quaqua is found on the coast of Guinea. The Europeans apply it to a horde of Negroes to the east of Cape Lahou.

[^116]:    * Caudice gracili aculeato, foliis pinnatis. Possibly of the genus Aiphanes of Willdenouw.
    $\dagger$ I shall in future use the word Llamos (loca plama, suppressing the $p$ ), without adding the equivelent words pampas, savannahs, meadows, steppes, or plains. The country between the mountains of the coast and the left bank of the Orinoco, constitutes the llanos of Cumana, Barcelona, and Caracas.

[^117]:    * " Æthiopes nigri, crispi lanati ; Pariæ incolæ albi, capillis oblongis protensis flavis."-Pet. Martyr, Ocean., dec. 1, lib. vi., (ed. 1574). "Utriusque sexus indigenæ albi veluti nostrates, præter eos qui sub sole versantur." (The natives of both sexes are as white as our people [Spaniards], except those who are exposed to the sun.)-Ibid. Gomara, speaking of the natives seen by Columbus at the mouth of the river of Cumana, says: "Las donzellas eran amorosas, desnudas y blancas (las de la casa); los Indios que van al campo estan negros del sol." (The young women are engaging in their manners : they wear no clothing, and those who live in the houses are white. The Indians who are much in the open country are black, from the effect of the sun.)-Hist. de los Indios, cap. 74. "Los Indios de Paria son blancos y rubios."-(The Indians of Paria are white and red.) Garcia, Origen de los Indios, 1729, lib. iv. cap. 9.
    + "They wear round their head a striped cotton handkerchief."Ferd. Columb., cap. 71. (Churchill, vol. ii.) Was this kind of headdress taken for a turban? (Garcia, Origen de los Ind., p. 303). I am surprised that people of these regions should have worn a head-dress; but, what is more curious still, Pinzon, in a voyage which he made alone to the coast of Paria, the particulars of which have been transmitted to us by Peter Martyr of Anghiera, professes to have seen natives who were clothed: "Incolas omnes genu tenus mares, fœminas surarum tenus, gossampinis vestibus amictos simplicibus repererunt; sed viros more Turcorum insuto minutim gossypio ad belli usum duplicibus." (The natives were clothed in thin cotton garments; the men's reaching to the knee, and the women's to the calf of the leg. Their war-dress was thicker, and closely stitched with cotton after the Turkish manner.) -Pet. Martyr, dec. ii., lib. vii. Who were these people described as being comparatively civilized, and clothed with tunics (like those who lived on the summit of the Andes), and seen on a coast, where before and since the time of Pinzon, only naked men have ever been seen ?

[^118]:    * Churchill's Collection, vol. ii. Herrera, pp. 80, 83, 84. Munoz, Hist. del Nuevo Mundo, vol. i., "El color era baxo como es regular en los Indios, pero mas claro que en las islas reconocidas." (Their colour was dark, as is usual among the Indians; but lighter than that of the people of the islands previously known.) The missionaries are accustomed to call those Indians who are less black, less tawny, whitish $h_{5}$ and even cilmost white.-Gumilla, Hist. de l'Orenoque, vol. i., chap. v., $f 2$. Such incorrect expressions may mislead those who are not accustomed to the exaggerations in which travellers often indulge.
    + Valtu non multum speciosi sunt, quoniam latas facies Tartariie adsimilatas habent. (Their countenances are not bandsome, their cheekbones being broad like those of the Tartars.)-Americi Veaputii Navigatio Prima, in Gryn's Orbis Norus, 1585.

[^119]:    * Vater, in Mithridates, vol. iii. Egede, Krantz, Hearne, Mackenzie, Portlock, Chwostoff, Davidoff, Resanoff, Merk, and Billing, have described the great family of these Tschougaz-Esquimaux.
    $\uparrow$ I mean here only the Tschouktsches who have fixed dwelling-places, for the wandering Tschouktsches approach very near the Koriaks.
    $\ddagger$ Krantz, Hist. of Greenland, 1667, tom. i. Greenland does not seem to have been inhabited in the eleventh century; at least the Esquimaux appeared only in the fourteenth, coming from the west.

[^120]:    * I have not observed any direct relation between the scintillation of the stars and the dryness of that part of the atmosphere open to our researches. I have often seen at Cumana a great scintillation of the stars of Orion and Sagittarius, when Saussure's hygrometer was at $85^{\circ}$. At other times, these same stars, considerably elevated above the horizon, emitted a steady and planetary light, the hygrometer being at $90^{\circ}$ or $93^{\circ}$. Probably it is not the quantity of vapour, but the manner in which it in diffused, and more or less dissolved in the air, which determines the scintillation. The latter is invariably attended with a coluration of light. It is remarkable enough, that, in northern countries, at a time when the atmosphere appears perfectly dry, the scintillation is most decided in very cold weather.

[^121]:    * M. Arago and I paid a great deal of attention to this phenomenon during a long series of observations made in the year 1809 and 1810, at the Observatory of Paris, with the view of verifying the declination of the stars.

[^122]:    * In the Memoirs of the Pennsylvanian Society.

[^123]:    * In Paris and in London the sky was cloudy. At Carlsruhe, before dawn, lightning was seen in the north-west and south-east. On the 13th of November a remarkable glare of light was seen at the same place in the south-east.

[^124]:    * According to the observations which I made on the ridge of the Andes, at an elevation of 2700 toises, on the moutons, or little white fleecy clouds, it appeared to me, that their elevation is sometimes not less than 6000 toises above the level of the coast.
    $\dagger$ M. Chladni, who at first considered falling-stars to be aêrolites, subsequently abandoned that idea.

[^125]:    * Ritter, like several others, makes a distinction between bolides mingled with falling-stars and those luminous meteors which, enveloped in vapour and smoke, explode with great nuise, and let fall (chiefly in the day-time) aërolites. The latter certainly do not belong to our atmosphere.

[^126]:    * See Views of Nature, (Bohn's edition,) p. 246.
    + There are three of the Caracas islands and eight of the Chimanas.

[^127]:    * Kieselschiefer of Werner.
    $\dagger$ In Switzerland, the hornstone passing into common jasper is found in kidney-stones, and in layers both in the Alpine and Jura limestone, especially in the former.
    $\ddagger$ The transition-limestone and schist.
    § We saw some of it as ballast, in a fishing-boat at Punta Araya, Its fragments might have been mistaken for basalt.

[^128]:    - Suriana maritima.

[^129]:    * Dickflasriger gneiss.
    $\dagger$ Between the meridians of Maniquarez and Higuerote.
    $\ddagger$ Bauhinia ferruginea, Brownea racemosa, Bred. Inga hymenseifolia J. curiepensis (which Willdenouw has called by mistake I. caripensis), de.

[^130]:    * In the oriental plague (another form of typhus characterised by great disorder of the lymphatic system) immediate contact is less to be feared than is generally thought. Larrey maintains that the tumified glands may be touched or cauterized without danger; but he thinks we ought net to riok putting on the clothes of persons attacked with the plague.-Mémoire sur les Maladies de l'Armée Prançoise en Egypte, p. 35.

[^131]:    * Glimmerschiefer. $\dagger$ Chloritschiefer.

[^132]:    * Especially below the Cross of La Guayra, at 594 toises of absolute elevation.

[^133]:    - "Vi sono molti Spagnuoli che tengono per cosa certa, che quest' isola (San Dominico) in breve tempo sara posseduta da questi Mori di Guinea." (Benzoni, Istoria del Mondo Nuovo, ediz. 2da, 1672, p. 65.) The author, who is not very scrupulous in the adoption of statistical facts, believes that in his time there were at St. Domingo seven thousand fugitive negroes (Muri cimaroni), with whom Don Luis Columbus made a treaty of peace and friendship.

[^134]:    - At the foot of the high mountain of Cocuyza, 3 east from Victoria.

[^135]:    * I have spoken, in the preceding chapter, p. 374, of the interruption in the chain of the coast to the east of Cape Codera.
    + The foundation of Santiago de Leon de Caracas dates from 1567, and is posterior to that of Cumana, Coro, Nueva Barcelona, and Caraval. leda, or El Collado.
    $\ddagger$ Throughout America water is supposed to share the properties of those plants under the shade of which it flows. Thus, at the Straits

[^136]:    * I found, at the square of Trinidad, the apparent height of the Silla to be $11^{\circ} 12^{\prime} 49^{\prime \prime}$. It was about four thousand five hundred toises distant.

[^137]:    * Between $16^{\circ}$ and $20.8^{\circ}$ Reaum.
    $\dagger$ Between $12.8^{\circ}$ and $14.4^{\circ}$ Reaum.

[^138]:    * The consumption of provisions, especially meat, is so considerable in the towns of Spanish America, that at Caracas, in 1800, there were 40,000 oxen killed erery year : while in Paris, in 1793, with a population fourteen times as great, the number amounted only to $\mathbf{7 0 , 0 0 0}$.

[^139]:    * Ficus nymphexifolia, Erythrina mitis. Two fine species of mimon are found in the same valley; Inga fastuosa, and I. cinerea.

[^140]:    * Since my experiments on slopes, mentioned at p. 94, I have discovered in the Figure de la Terre of Bouguer, a passage, which shows that this astronomer, whose opinions are of such weight, considered also $36^{\circ}$ as the inclination of a slope quite inaccessible, if the nature of the ground did not admit of forming steps with the foot.

[^141]:    - Salix Humboldtiana of Willdenouw. On the alpine palm-treee, we my Prolegomena de Dist. Plant. p. 235.
    $\dagger$ It is a great advantage of the Spanish language, and a peculiarity which it shares in common with the Latin, that, from the name of a tree, may be derived a word designating an association or group of trees of the same species. Thus are formed the words olivar, robledar, and pinal, from olivo, roble, and pino. The Hispano-Americans have added tural, pejual, guayaval, \&c., places where a great many Cactuses, Gualtheria odoratas, and Psidiums, grow together.
    $\ddagger$ For the explanation of these words, see p. 178.
    \& We may compare together either latitudes which in the same hemisphere present the same mean temperature (as, for instance, Peansylvamis and the central part of France, Chile and the southern part of New Holland); or we may consider the relations that may exist between the vegetation of the two hemispheres under isothermal parallels.

[^142]:    * The geography of plants comprises not merely an examination of the analogies observed in the same hemisphere; as between the vegetation of the Pyrenees and that of the Scandinavian plains; or between that of the Cordilleras of Peru and of the coasts of Chile. It atso investigates the rekations between the alpine plants of both hemispheres. It comparae the vegetation of the Alleghanies aad the Cordilleras of Mexico, with that of the mountains of Chile and Brazil. Bearing in mind that every isothermal line has an alpine branch (as, for instance, that which connects Upsala with a point in the Swiss Alps), the great problem of the analogy of vegetable forms may be defined as follows: lst, examining in each hemisphere, and at the level of the coasts, the vegetation on the same isothermal line, especially near convex or concave summits; 2nd, comparing, with respect to the form of plants, on the same isothermal lime north and south of the equator, the alpine branch with that traced in the plains; 3rd, comparing the vegetation on homonymous isothermal lines in the two hemispheres, either in the low regions, or in the alpine regions.
    $\dagger$ Phleum alpinum, examined by Mr. Brown. The investigations of this great botanist prove that a certain number of plants are at once common to both hemispheres. Potentilla anserina, Pranella valgaris, Scirpus mucronatus, and Panicum crus-galli, grow in Germany, in Australia, and in Pennsylvania.
    $\ddagger$ The Viola cheiranthifolia has been found by MM. Kunth and Voa Buch among the alpine plants which Jussieu brought from the Pyrencea,

[^143]:    * Cyperus mucronatus, Poa eragrostis, Festuca myurus, Andropogon avenaceus, Lapago racemosa. (See the Nova Genera et Species Plantarum, vol. i. p. xxv.)

[^144]:    * The names vine-tree, and uvas camaronas, are given in the Andes to plants of the genus Thibaudia, on account of their large succulent fruits. Thus the ancient botanists gave the name of bear's vine, uva ursi, and vine of Mount Ida (Vitis idæea), to an arbutus and a myrtillus, which belong, like the thibaudia, to the family of the Ericineæ.
    + Nertera depressa, Aralia reticulata, Hedyotis blærioides.

[^145]:    * The stratum of air, the mean temperature of which is $0^{\circ}$, and which scarcely coincides with the superior limit of perpetual snow, is found in the parallel of the rhododendrons of Switzerland at nine hundred toises; in the parallel of the befarias of Caracas, at two thousand seven hundred toises of elevation.
    † Vismia caparosa (a loranthus clings to this plant, and appropriates to itself the yellow juice of the vismia) ; Davallia meifolia, Heracium avile, Aralia arborea, Jacq., and Lepidium virginicum. Two new species of lycopodium, the thyoldes, and the aristatum, are seen lower downnear the Puerta de la Silla.
    $\ddagger$ Trixis nereifolia of M. Bonpland.

[^146]:    * Scitamineous plants, or family of the plantains.
    + Arundo donax.
    $\ddagger$ Befaria.
    \& Heliconia psittacorum, and H. bihai. These two heliconias are very common in the plains of Terra Firma.

[^147]:    - Observations of the latitude give for the horizontal distance between the foot of the mountain near Caravalleda, and the vertical line passing through its summit, scarcely 1000 toises.

[^148]:    * See Views of Nature, Bohn's edition, p. 358.

[^149]:    - The difference of longitude between the Silla and La Guayra, according to Fidalgo, is $0^{\circ} \boldsymbol{0}^{\prime} 40^{\prime}$.

[^150]:    - I have seen fragments of quartz traversed by parallel bands of magmetic iron, earried into the valley of Caracas by the waters descending from the Galipeno and the Cerro de Avila. This banded magnetic ironore is found also in the Sierra Nevada of Merida. Between the two peoles of the Silla, angular fragments of cellular quartz are found, covered with red oxide of iron. They do not act on the needle. This oxide is of a cinnabar-red colour.

[^151]:    * In the direction of north-west the slopes appear more accessible; and I have been told of a path frequented by smugglers, which leads to Caravalleda, between the two peaks of the Silla. From the eastern peak I took the bearings of the western peak, $64^{\circ} 40^{\prime} \mathrm{S}$.W.; and of the houses, which I was told belonged to Caravalleda, $55^{\circ} 20^{\prime}$ N.W.
    $\dagger$ Aegopogon cenchroides.

[^152]:    * Fragments of brown copper-ore were found mixed with these pebbles, at an elevation of 1170 toises.

[^153]:    * Gay-Lassac's account of his ascent on the 15th of Septamber, 1805.

[^154]:    * It was formerly believed that the height of the Silla. of Carsoas scarcely differed from that of the peak of Teneriffe.
    $\dagger$ Especially at great elevations.

[^155]:    * Real de Minas de San Felipe de Buria. $\dagger$ Nueva Segovia

[^156]:    - For instance, the nocturnal procession of the 21st of October, instituted in commemoration of the great earthquake which took place cm that day of the month, at one o'clook in the morning, in 1778. Other very violent chocks were those of 1641, 1703, and 1802.

    4 Betwesp latituctes $5^{\circ}$ and $.36^{\circ}$ North, and $31^{\circ}$ and $91^{\circ}$ West lon. from Paris.

[^157]:    - Malte-Brun, Géographie Universelle. There is, however, some doubt respecting the eruption of 1628, to which some accounts assign the date of 1638. The rising always happened near the island of St. Michael, though not identically on the same spot. It is remarkable that the small island of 1720 reached the same elevation as the island of Sabrina in 1811.

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[^159]:    - The duration of the earthquake, that is to say the whole of the movements of undulation and rising (undulacion $y$ trepidacion), which occasioned the horrible catastrophe of the 26th of March, 1812, was eatimated by some at $50^{\prime \prime}$, by others at $1^{\prime} 12^{\prime \prime}$.
    + As far as Villa de Los Remedios, and even to Carthagena.
    $\ddagger$ This is easily explained according to the system of those geologists who are of opinion that all chains of mountains, volcanic and not volcanic, have been formed by being raised up, as if through crevices.
    § It is asserted that, in the mountains of Aroa, the ground, immediately after the great shocks, was found covered with a very fine and white earth, which appeared to have been projected through crevicea.

[^160]:    * These gruinsteins are found in Bohemia, near Pilsen, in granite; in Saxony, in the mica-slates of Scheenberg; in Franconia, between Steeben and Lauenstein, in transition-slates.

[^161]:    * Where the contrary is not expressly stated, nautical leagues of twenty to a degree, or two thousand eight hundred and fifty-five toisea, are always to be understood.
    $\dagger$ This is the distance from Vesuvius to Mont Blanc.

[^162]:    - I have already observed (p. 113) that the whole group of the Canary Islands rises, as we may say, above one and the same submarine volcano. Since the sixteenth century, the fire of this volcano has burst forth alternately in Palma, Teneriffe, and Lancerote. Auvergne presents a whole system of volcanos, the action of which has now ceased; but in the middle of a system of active volcanos, for instance, in that of Quito, we must not consider as an extinguished volcano a mountain, the crater of which is obstructed, and through which the subterraneous fire has not issued for ages. Etna, the Eolian Isles, Vesuvius, and Epomeo ; the peak of Teyde, Palma, and Lancerote; St. Michael, La Caldiera of Fayal, and Pico; St. Vincent, St. Lucia, and Guadaloupe; Orizava, Popocatepetl, Jorullo, and La Colima; Bombacho, the volcano of Gremada, Telica, Momotombo, Isalco, and the volcano of Guatimala;

[^163]:    * In the town of Guanaxuato, in Mexico, these thunders lasted from the 9th of January till the 12th of February, 1784. Guanaxuato is situated forty leagues north of the volcano of Jorullo, and sixty leagues north.west of the volcano of Popocatepetl. In places nearer these two volcanos, three leagues distant from Guanaxuato, the subterranean thunders were not heard. The noise was circumscribed within a very narrow space, in the region of a primitive schist, which approaches a transition-schist, containing the richest silver mines of the known world, and on which rest trap-porphyries, slates, and diabasis (grinstein.)

[^164]:    - Raffles, History of Java, 1817, pp. 23-28. The principal line of the volcanos of Java, on a distance of 160 leagues, runs from west to east, through the mountains of Gagak, Gedé, Tankuban-Prahu, Ungarang, Merapi, Lawu, Wilis, Arjuna, Dasar, and Tashem.

[^165]:    * The inflammable emanations of Pietra Mala, (consisting of hydrogen gas containing naphtha in a state of suspension) issue from the Alpine limestone, which may be traced from Covigliano to Raticofa, and which lies on ancient sandstone near Scarica l'Asino. Under this sandstone (old red sandstone) we find black transition limestone and the grauwacke (quartzose psammite) of Florence.

[^166]:    * Valley of Cortes, or Easter Valley, so called because Diego de Losada, after having defeated the Teques Indians, and their cacique Guaycaypuro, in the mountains of San Pedro, spent the Easter there in 1567, before entering the valley of San Francisco. In the latter place he founded the city of Caracas.

[^167]:    - Ur-grünstein. I remember having seen similar balls filling a vein in transition-slate, near the castle of Schauenstein in the margravate of Bayreuth. I sent several balls from Antimano to the collection of the king of Spain at Madrid.
    $\dagger$ Kieselschiefer. $\ddagger$ Alaunschiefer.

[^168]:    * G. saccharoides. + Laurus persea (alligator pear).

[^169]:    - The berries heaped together produce a vinous fermentation, during which a very pleasant alcoholic smell is emitted. Placing, at Caracas, the ripe fruit of the coffee-tree under an inverted jar, quite filled with water, and exposed to the rays of the sun, I remarked that no extrication of gas took place in the first twenty-four hours. After thirty-six hours the berries became brown, and yielded gas. A thermometer, enclosed in the jar in contact with the fruit, kept at night $4^{\circ}$ or $5^{\circ}$ higher than the external air. In the space of eighty-seven hours, sixty berries, under various jars, yielded me from thirty eight to forty cubic inches of a gas, which underwent no sensible diminution with nitrous gas. Though a great quantity of carbonic acid had been absorbed by the water as it was produced, I still found 0.78 in the forty inches. The remainder, or 0.22 , was nitrogen. The carbonic acid had not been formed by the absorption of the atmospheric oxygen. That which is evolved from the berries of the coffee-tree slightly moistened, and placed in a phial with a glass stopple filled with air, contains alcohol in suspension; like the foul air which is formed in our cellars during the fermentation of must. On agitating the gas in contact with water, the latter acquires a decidedly alcoholic flavour. How many substances are perhaps contained in a state of suspension in those mixtures of carbonic acid and hydrogen, which are called deleterious miasmata, and which rise everywhere within the tropics, in marshy grounds, on the sea-shore, and in forests where the soil is strewed with dead leaves, rotten fruits, and putnefying insects.

[^170]:    * Pancratium undulatum.

[^171]:    - That part of the year most abundant in rain is called winter; so that in Terra Firma, the season which begins by the winter solstice, is designated by the name of summer; and it is usual to hear, that it is winter on the mountains, at the time when summer prevails in the neighbouring plains.
    $\uparrow$ Hura crepitans.
    $\ddagger$ French measure, nearly fifty metres.

[^172]:    * Tallsschiefer of Werner, without garnets or serpentine; not eurite or weisstein. It is in the mountains of Buenavista that the gneiss manifect a tendency to pass into eurite.

[^173]:    " Amyris elata.

[^174]:    Edinburgh, (lat. $56^{\circ}$ ), is found again on the table-lands of New Grenada, so rich in wheat, at 1400 toises of elevation, and at $4^{\circ} \mathrm{N}$. latitude. On the other hand, we find the mean temperature of the valleys of Aragua, lat. $10^{\circ} 13^{\prime}$, and of all the plains which are not very elevated in the torrid zone, in the summer temperature of Naples and Sicily, lat. $39^{\circ}$ to $40^{\circ}$ These figures indicate the situation of the isotheric lines (lines of the same summer heat), and not that of the isothermal lines (those of equal annual temperature). Considering the quantity of heat received on the same spot of the globe during a whole year, the mean temperatures of the valleys of Aragua, and the table-lands of New Grenada, at 300 and 1400 toises of elevation, correspond to the mean temperatures of the coasts at $23^{\circ}$ and $45^{\circ}$ of latitude.

[^175]:    - The minaos of La Guayre; zamang being the Indian name for the genera mimosa, desmanthus, and aeacia. The place where the tree is found is called El Guayre.

[^176]:    and it is more natural to consider as the limits of the basin of Aragua a line drawn through the sources of the streams flowing into the lake of Valencia. The charts and sections I have traced of the road from Caracas to Nueva Valencia, and from Porto Cabello to Villa de Cura, exhibit the whole of these geological relations.

[^177]:    * Isla de Cara and Cabo Blanco. The promontory of Cabrera has been connected with the shore ever since the year 1750 or 1760 by a little valley, which bears the name of Portachuelo.

[^178]:    * Los Nuevos Peñones (the New Rocks). Los Aparecidos (the Un-expectedly-appeared).
    + The following are their names : Rios de Aragua, Turmero, Maracay, Tapatapa, Aguas Calientes, Mariara, Cura, Guacara, Guataparo, Valencia, Caño Grande de Cambury, \&c.

[^179]:    * In his 'Voyage à la Terre Ferme,' M. Depons says, "The small extent of the surface of the lake renders impossible the supposition that evaporation alone, however considerable within the tropics, could remove as much water as the rivers furnish." In the sequel, the author himself seems to abandon what he terms "this occult case, the hypothesis of an aperture."

[^180]:    * The dividing ridge, namely, that which divides the waters between the valleys of Aragua and the Llanos, lowers so much towards the west of Guigue, as we have already observed, that there are ravines which conduct the waters of the Cafo de Cambury, the Rio Valencia, and the Guataparo, in the time of floods, to the Rio Pao; but it would be easier to open a navigable canal from the lake of Valencia to the Orinoco, by the Pao, the Portuguesa, and the Apure, than to dig a draining canal level with the bottom of the lake. This bottom, according to the sounding, and my barometric measurements, is 40 toises less than 222, or 182 above the surface of the ocean. On the road from Guigue to the Llanos, by the table-land of La Villa de Cura, I found, to the south of the dividing

[^181]:    ridge, and on its southern declivity, no point of level corresponding to the 182 toises, except near San Juan. The absolute height of this village is 194 toises. But. I repeat that, farther towards the west, in the country between the Cafio de Cambury and the sources of the Rio Pao, which I was not able to visit, the point of level of the bottom of the lake is much further north.

[^182]:    *This is the difference between the absolute elevatious of the lakes of Geneva and Thun.

[^183]:    * It is almost superfluous to observe that I am considering here only that part of the atmosphere lying on the ocean between $10^{\circ}$ north and $10^{\circ}$ south latitude. Towards the northern limits of the torrid zone, in latitude $23^{\circ}$, whither the north winds bring with an extreme rapidity the cold air of Canada, the thermometer falls at sea as low as $16^{\circ}$, and even lower.
    + The position of these islands is as follows: northward, near the shore, the Isla de Cura; on the south-east, Burro, Horno, Otama, Sorro, Caiguira, Nuevos Peñones, or the Aparecidos; on the north-west, Cabo Blanco, or Isla de Aves, and Chamberg; on the south-west, Brucha and Culebra. In the centre of the lake rise, like shoals or small detached rocks, Vagre, Fraile, Peñasco, and Pan de Azucar.

[^184]:    * The bava, or bavilla, is very common at Bordones, near Cumana. See vol. i, p. 160. The name of bava (baveuse) has misled M. Depons; he takes this reptile for a fish of our seas, the Blennius pholis. (Voyage à la Terre Ferme.) The Blennius pholis (smooth blenny), is called by the French laveuse (slaverer), in Spanish, baba.

[^185]:    * The water of the lake is not salt, as is asserted at Caracas. It may. be drunk without being filtered. On evaporation it leaves a very small residuum of carbonate of lime, and perhaps a little nitrate of potash. It is surprising that an inland lake should not be richer in alkaline and earthy salts, acquired from the neighbouring soils.

[^186]:    * The tomatos are cultivated, as well as the papaw-tree of the lake, in the Botanical Garden of Berlin, to which I had sent some seeds.
    $\dagger$ The people of the country attribute to it an astringent quality, and call it tapaculo.

[^187]:    * Every tree of the Carolinea princeps at Schönbrunn has sprung from seeds collected from one single tree of enormous size, near Chacao, east of Caracas.
    † A tablon, equal to 1849 square toises, contains nearly an acre and one-fifth : a legal acre has 1344 square toises, and 1.95 legal acre is equal to one bectare.

[^188]:    * In the island of Palma, where in the latitude of $29^{\circ}$ the sugar-cane is said to be cultivated as high as 140 toises above the level of the Atlantic, the Otaheite cane requires more heat than the Creole cane.
    $\dagger$ The Indian name for the sugar-cane is sharkara. Thence the word monar.

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[^190]:    * Un abogado contra los harmigos.

[^191]:    when we billed that bad and ambitious captain. We chose a caballero of Seville, Fernando de Guzman, for king : and we swore fealty to him, as is done to thyself. I was named quarter-master-general : and because I did not consent to all he willed, he wanted to kill me. But I killed this new king, the captain of his guards, his lieutenant-general, his chaplain, a woman, a knight of the order of Rhodes, two ensigns, and five or six domestics of the pretended king. I then resolved to punish thy ministers and thy auditors (counsellors of the audiencia). I named captains and sergeants: these again wanted to kill me, but I had them all hanged. In the midst of these adventures we navigated for eleven months, till wo reached the mouth of the river. We sailed more than fifteen hundred leagues. God knows how we got through that great mass of water. I advise thee, $\mathbf{O}$ great King, never to send Spanish fleets into that accursed river. God preserve thee in his holy keeping."
    This letter was given by Aguirre to the vicar of the island of Margareta, Pedro de Contreras, in order to be transmitted to King Philip II. Fray Pedro Simon, Provincial of the Franciscans in New Grenada, saw several manuscript copies of it both in America and in Spain. It was printed, for the first time, in 1723, in the History of the Province of Venezuela, by Oviedo, vol. i, p. 206. Complaints no less violent, on the conduct of the monks of the 16 th century, were addressed directly to the pope by the Milanese traveller, Girolamo Benzoni.

    * See vol. i, p. 164.

[^192]:    * At Ochsenkopf, at Rudolphstein, at Epprechtstein, at Luxburg, and at Schneeberg. The dip of the strata of these granites of Fichtelberg is. generally only from $6^{\circ}$ to $10^{\circ}$, rarely (at Scheeberg) $18^{\circ}$. According to the dips I observed in the neighbouring strata of gneiss and mica-slate, I should think that the granite of Fichtelberg is very ancient, and serves as a basis for other formations ; but the strata of grunstein, and the disseminated tin-ore which it contains, may lead us to doubt its great ano tiquity, from the analogy of the granites of Saxony containing tin.

[^193]:    - I have treated in another work of the proportions of mortality in the yellow fever. (Nouvelle Espagne, vol. ii, p. 777, 785, and 867.) At Cadiz the average mortality was, in 1800, twenty per cent; at Seville, in 1801, it amounted to sixty per cent. At Vera Craz the mortality does ${ }^{1}$ fot exceed twelve or fifteen per cent. when the sick can be properly attended. In the civil hospitals of Paris the number of deaths, one yeas with another, is from fourteen to eighteen per cent.; but it is asserted that a great number of patients enter the hospitals almost dying, or at a very advanced time of life.
    $\dagger$ In the West India Islands all the dreadful maladies which prevail daring the niatry season, have been for a long time attributed to the south winds. These winds convey the emanations of the mouths of the Orinoco and of the small rivers of Terra Firma toward the high latitudes.

[^194]:    * The wrecks of the Spanish ships, burnt at the island of Trinidad, at the time of its occupation by the English in 1797, were carried by the general or rotary current to Punta Brava, near Porto Cabello. This general current toward the east, from the coasts of Paria to the isthmus of Panama and the western extremity of the island of Cuba, was the subject of a violent dispute between Don Diego Columbus, Oviedo, and the pilot Andres, in the sixteenth century.

[^195]:    * It is disputed at Porto Cabello whether the port takes its name from the tranquillity of its waters, "which would not move a hair (cabello)," or (which is more probable) derived from Antonio Cabello, one of the fishermen with whom the smugglers of Curaçoa had formed a connexion at the period when the first hamlet was constructed on this half-desert coast.

[^196]:    * The Minedor is situate enstward of the Vigia Alte, and south-east of the battery of the salt-works and the powder-mill.

[^197]:    - "Inter arbores que sponte hic passim nascuntur, memorantur a scriptoribus Hispanis quædam quæ lacteum quemdam liquorem fundunt, qui durus admodum evadit instar gummi, et suavem odorem de se fundit; aliæ quæ liquorem quemdam edunt, instar lactis coagulati, qui in cihis ab ipsis usurpatur sine noxa." (Among the trees growing here, it is re-

[^198]:    marked by Spanish writers that there are some which pour out a milky jaice which soon grows solid, like gum, affording a pleasant odour ; and also others that give out a liquid which coagulates like cheese, and which they eat at meals without any ill effects). Descriptio Indiarum Occidentalium, lib. 18.

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[^199]:    - The same viscosity is also remarked in the fresh milk of the palo de vaca. It is no doubt occasioned by the caoutchouc, which is not yet separated, and which forms one mass with the albumen and the caseum, as the butter and the caseum in amimal milk. The juice of a euphorbiaceous plant (Sapium aucuparium), which also yields caontchouc, is so glutinous that it is used to catch parrots.

[^200]:    * The milk of the lactescent agarics has not been separately analysed ; it contains an acrid principle in the Agaricus piperatus; and in other species it is sweet and harmless. The experiments of MM. Braconnots

[^201]:    * Or "farewell to flesh." The word carnival has the same meaning, these sports being always held just before the commencement of Lent.

    > † Dólichos pruriens (cowage).
    $\ddagger$ The province, not the capitania-general, consequently not including the cacao plantations of Cumana, the province of Barcelona, of Maracaybo, of Varinas, and of Spanish Guiana.

[^202]:    * Parrots, monkeys, agoutis, squirrels, and stags.

[^203]:    *The valley of Buria, and the little river of the same name, communicate with the valley of the Rio Coxede, or the Rio de Barquenimoto.

[^204]:    * This little river descends from the Paramo de los Conejos, and flows into the Rio Albarregas.

[^205]:    - Simia ursina.
    † Simia belzebuth.
    $\ddagger$ Ulloa has not hesitated to represent in an engraving this extraordinary feat of the monkeys with a prehensile tail.-See Viage a la America Meridional (Madrid, 1748).

[^206]:    * "Die Teufels Mauer," near Wernigerode in Germany.

[^207]:    * One of these veins, on which two shafts have been sunk, was directed hor. $2 \cdot 1$, and dipped $80^{\circ}$ east. The strata of the serpentine, where it is stratified with some regularity, run hor. 8, and dip almost perpendicularly. I found malachite disseminated in this serpentine, where it passes into grinnstein.
    $\dagger$ I had an opportunity of examining again, with the greatest care, the rocks of San Juan, of Chacao, of Parapara, and of Calabozo, during my stay at Mexico, where, conjointly with M. del Rio, one of the most distinguished pupils of the school of Freyberg, I formed a geognostical collection for the Colegio de Mineria of New Spain.

[^208]:    * Between Tampadel and Silsterwiz.
    + In the mountains of Bareuth, in Franconia, so abundant in grïnstein and serpentine, these formations are not connected together. The serpentine there belongs rather to the schistose hornblende (hornblendschiefer), as in the island of Cuba. Near Guanaxuato, in Mexico, I saw it alternating with syenite. These phenomena of serpentine rocks forming layers in eurite (weisstein), in schistose hornblende, in gabbro, and in syenite, are so much the more remarkable, as the great mass of garnetiferous serpentines, which are found in the mountains of gneiss and mica-slate, form little distinct mounts, masses not covered by other formations. It is not the same in the mixtures of serpentine and granul limestone.

[^209]:    * On advancing into the adit for draining the Friedrich-Wilhelmstollen mine, which I caused to be begun in 1794, near Steben, and which is yet only 340 toises long, there have successively been found, in the transitionslate subordinate strata of pure and porphyritic grinstein, strata, of Lydian stone and ampelite (alaunschiefer), and strata of fine-grained griinstein. All these strata characterise the transition-slates.
    $\dagger$ For instance, at the Glyshorn, at the Col de Balme, \&cc.
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[^210]:    * For instance, at Krobsdorf, in Silesia, a stratum of bacalt has been recognized in the mica-slate by two celebrated geologists, MM. von Buch and Raumer. (Vom Granite des Riesengebirges, 1813.)
    $\dagger$ The grinsteins or diabases of the Fichtelgebirge, in Franconia, which belong to the transition-slate, sometimes conain pyroxenes.
    $\ddagger$ From the Rio Negro to the coasts of Cumana and Caracas, to the east of the mountains of Merida, which we did not visit.

[^211]:    * For example, the road from the valley of Ursern to the Hospice of St. Gothard, and thence to Airolo.
    + A thermometer, placed in the sand, rose to $38 \cdot 4^{\circ}$ and $40^{\circ}$ Reaumur.

[^212]:    * These vast steppes of Hungary are elevated only thirty er forty toises above the level of the sea, which is more than eighty leagues distant from them. (See Wahlenberg's Flora Carpathianica.) Baron Podmanitzky, an Hungarian nobleman, highly distinguished for his knowledge of the physical sciences, caused the level of these plains to -be taken, to facilitate the formation of a canal then projected between the Danube and the Theiss. He found the line of division, or the convexity of the ground, which slopes on each side towards the beds of the two rivers, to be only thirteen toises above the height of the Danube. The widely extended pastures, which reach in every direction to the horizon, are called in the country, Puszta, and, over a distance of many leagues, are without any human habitation. Plains of this kind, intermingled with marshes and sandy tracts, are found on the western side of the Theiss, between Czegled, Csaba, Komloss, and Szarwass; and on the eastern side, between Debreczin, Karczag, and Szoboszlo. The area of these plains of the interior basin of Hungary has been estimated, by a pretty accurate calculation, to be between two thousand five hundred and three thoumand square leagues (twenty to a degree). Between Czegled, Szolnok, and Ketskemet, the plain resentbles a sea of sand.

[^213]:    * We are almost tempted, however, to give the name of desert to that vast and sandy table-land of Brazil, the Campos dos Parecis, which gives birth to the rivers Tapajos, Paraguay, and Madeira, and which reaches the summit of the highest mountains. Almost destitute of vegetation, it reminds us of Gobi, in Mongolia.

[^214]:    * "C. Manlium prope jugis [Tauri] ad divortia aquarum castra posuisse." Livy, lib. 38, c. 75.
    $\dagger$ This is the distance from Timbuctoo to the northern coast of Africa.

[^215]:    are covered with snow; but this colossal group almost belongs to the Andes de la Paz, of which it forms a promontory or spur, directed toward the east.

    * To the west, in consequence of the Llanos of Manso, and the Pampas de Huanacos, the forests do not extend generally beyond the parallels of $18^{\circ}$ or $19^{\circ}$ south latitude; but to the east, in Brazil (in the capitanias of San Pablo and Rio Grande), as well as in Paraguay, on the borders of the Parana, they advance as far as $25^{\circ}$ south.
    $\dagger$ Savankas limpias, that is to say, clear of trees.
    $\ddagger$ In New Grenada, Quito, and Peru, according to measurements taken by Bouguer, La Condamine, and myself.

[^216]:    * We do not reckon here, as belonging to the chain of the coast, the Nevados and Paramos of Merida and of Truxillo, which are a prolonga. tion of the Andes of New Grenada.

[^217]:    * In Siberia, the great steppes between the Irtish and the Obi, especially that of Baraba, full of salt lakes (Tchabakly, Tchany, Karasouk, and Topolony), appear to have been, according to the Chinese traditions, even within historical times, an inland sea.

[^218]:    *The Zaque was the secular chief of Cundinamarca. His power was shared with the high priest (lama) of Iraca.
    $\dagger$ The Farm of the Alligator.

[^219]:    *They are called in the country 'Venados de tierras calientes' (deer of the warm lands.)
    $\dagger$ This trade is carried on, but on a very limited scale, at Carora and at Barquesimeto.
    $\ddagger$ Killingia monocephala, K. odorata, Cenchrus pilosus, Vilfa tenacissima, Andropogon plumosum, Panicum micranthum, Poa repens, Paspalum leptostachyum, P. conjugatum, Aristida recurvata. (Nova Genera et Species Plantarum, vol. i, pp. 84-243.)
    $\|$ The sensitive-plant (Mimosa dormiens).
    8 Cypura graminea, Craniolaria annua (the scorzonera of the natives).

[^220]:    * The roofing palm-tree (Corypha tectorum).
    $\dagger$ Resembling the Embothrium, of which we found no species in South America. The embothriums are represented in American vegetation by the genera Lomatia and Oreocallis.

[^221]:    * This palm-tree of the plains must not be confounded with the palma real of Caracas and of Curiepe, with pinnate leaves.
    $\dagger$ Perhaps an Aiphanes.
    $\ddagger$ If the head of the moriche were better furnished with leaves than it generally is, we might perhaps admit that the soil round the tree preserves its humidity through the influence of the shade.

[^222]:    "Literally " tremblers," or "producers of trembling."
    $\dagger$ Cuvier, Règne Animal, vol. ii. The Mediterranean contains, acconding to M. Risso, four species of electrical torpedos, all formerly confounded under the name of Raia torpedo; these are Torpedo narke, T. unimaculata, T. galvanii, and T. marmorata. The torpedo of the Cape of Good Hope, the subject of the recent experiments of Mr. Todd, is, no doubt, a nondescript species.

[^223]:    * Amyris lateriflora, A. coriacea, Laurús pichurin, Myroxylon secun. dum, Malpighia reticulata.
    $\dagger$ Meaning to excite the fish by horses.

[^224]:    * The Indians assured us that when the horses are made to run two days successively into the same pool, none are killed the secoud day. See, on the fishing for gymnoti, "Views of Nature." (Bohn's ed., p. 18.)
    $\dagger$ We yet know with certainty only seven electrir fishes; Torpedo narke, Risso, T. unimaculata, T. marmorata, T. gaivanii, Silurus electricus, Tetraodon electricus, Gymnotus electricus. It appears uncertain whether the Trichiurus indicus has electrical properties or not. (See Cuvier's Règne Animal, vol. ii.) But the genus Torpedo, very different from that of the rays properly 80 called, has numerous species in the equatorial seas; and it is probable that there exist several gymnoti

[^225]:    * By MM. Williamson and Fahlberg. The following account is given by the latter gentleman. "The gymnotus sent from Surinam to M. Nörderling, at Stockholm, lived more than four months in a state of perfect health. It was twenty-seven inches long; and the shocks it gave were so violent, especially in the open air, that I found scarcely any means of protecting myself by non-conductors, in transporting the fish from one place to another. Its stomach being very small, it ate little at a time, but fed often. It approached living fish, first sending them from afar a shock, the energy of which was proportionate to the size of the prey. The gymnotus seldom failed in its aim; one single stroke was almost always sufficient to overcome the resistance which the strata

[^226]:    * The heterogeneous poles of the double electrical organs must exist in each organ. Mr. Todd has recently proved, by experiments made on torpedos at the Cape of Good Hope, that the animal continues to give violent shocks when one of these organs is extirpated. On the contrary, all electrical action is stopped (and this point, as elucidated by Galvani, is of the greatest importance) if injury be inflicted on the brain, or if the nerves which supply the plates of the electrical organs be divided. In the latter case, the nerves being cut, and the brain left untouched, the torpedo continues to live, and perform every muscular movement. A fish, exhausted by too numerous electrical discharges, suffered much more than another fish deprived, by dividing the nerves, of any communication between the brain and the electromotive apparatus. (Philosophical Transactions, 1816).

[^227]:    * In order to investigate the phenomena of the living electromotive apparatus in its greatest simplicity, and not to mistake for general conditions circumstances which depend on the degree of energy of the electric organs, it is necessary to perform the experiments on those electrical fishes most easily tamed. If the gymnoti were not known, we might suppose, from the observations made on torpedos, that fishes cannot give their shocks from a distance through very thick strata of water, or through a bar of iron, without forming a circuit. Mr. Williamson has felt strong shocks when he held only one hand in the water, and this hand, without touching the gymnotus, was placed between it and the small fish towards which the stroke was directed from ten or fifteen inches distance. (Philosophical Transactions, vol. Lxv, pp. 99 and 108).

[^228]:    When the gymnotus was enfeebled by bad health, the lateral shock was imperceptible; and in order to feel the shock, it was necessary to form a chain, and touch the fish with both hands at once. Cavendish, in his ingenious experiments on an artificial torpedo, had well remarked these differences, depending on the greater or less energy of the charge. (Philosophical Transactions, 1776, p. 212).

    * It appears, however, that a distinction is to be made between rahd, thunder, and rahadh, the electrical fish; and that this latter word means simply 'that which causes trembling.'

[^229]:    * At Malpaso and Piedras Azules.
    $\dagger$ Does this formation of secondary limestone of the Llanos contain galena? It has been found in strata of black marl, at Barbacoa, between Truxillo and Barquesimeto, north-west of the Llanos.
    $\ddagger$ Also near Cachipe and San Joacquim, in the Llanos of Barcelona.
    \& This trade is carried on at Parapara. A load of eight arrobas sells at Caracas for twenty-four piastres.

[^230]:    * Known in North America under the name of 'salt-licks.'

[^231]:    * The risings towards the north and west are connected with two lines of ridges, the mountains of Villa de Cura and of Merida. The third slope, running from north to sonth, is that of the land-strait between the Andes and the chain of Parime. It determines the general inclination of the Orinoco, from the mouth of the Guaviare to that of the Apare.
    $\dagger$ The colts are drowned everywhere in large numbers, because they are sooner tired of swimming, and strive to follow the mares in places where the latter alone can touch the ground.

[^232]:    * The maximum of the heat is not felt on the coast, at Cumana, at La Guayra, and in the neighbouring island of Margareta, before the month of September; and the rains, if the name can be given to a few drops that fall at intervals, are observed only in the months of October and November.

[^233]:    - These passages take place, in the fifth and tenth degrees of north lat. between the 3rd and the 16th of April, and between the 27 th of August and the 8 th of September.

[^234]:    * Ceyx alector, the peacock-pheasant ; C. pauxi, the cashew-bird.

[^235]:    * In order to measure the velocity of the surface of a river, I generally measured on the beach a base of 250 feet, and observed with the chronometer the time that a floating body, abandoned to the current, required to reach this distance.

[^236]:    * We counted eighteen on each side. On the hind feet, at the upper end of the metatarsus, there is a callosity three inches long and three quarters of an inch broad, destitute of hair. The animal, when seated, rests upon this part. No tail is visible externally; but on putting aside the hair we discover a tubercle, a mass of naked and wrinkled flesh, of a conical figure, and half an inch long.

[^237]:    - Near Uritucu, in the Caño del Ravanal, we saw a flock of eighty or one hondred of these animals.

[^238]:    - Father Gili observes that their Indian name is Uamu and Pau, and that they originally dwelt on the Upper Apure.
    $\dagger$ Their Indian name is Guahiva.
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[^239]:    - Geographers supposed, for a long period, that the Niger was entirely absorbed by the sands, and evaporated by the heat of the tropical sun, as no embouchure could be found on the western coast of Africa to meet the requirements of $s 0$ enormous a river. It was discovered, however, by the Landers, in 1830, that it does really flow into the Atlantic; yet the cause mentioned above is so powerful, that of all the numerous branches into which it separates at its mouth, only one (the Nun River) is navigable even for light ships, and for half the year even those are unable to enter.

[^240]:    - Salmo rhombeus, Linn.

[^241]:    +Garzon chico. It is believed, in Upper Egypt, that herons have an affection for crocodiles, because they take advantage in fishing of the terror that monstrous animal causes among the fishes, which he drives from the bottom to the surface of the water; but on the banks of the Nile, the heron keeps prudently at some distance from the crocodile.

[^242]:    * The first of these words belongs to the Tamanac language, and the second to the Ottomae. Father Gili proves, in opposition to Oviedo, that the manati (fish with hands) is not Spanish, but belongs to the languages of Hayti (St. Domingo) and the Maypures. I believe also that, according to the genius of the Spanish tongue, the animal would have been called manudu or manon, but not manati.

[^243]:    *We found, on the banks of the Apure, Ammania apurensis, Cordia cordifolia, C. grandiflora, Mollugo sperguloĩdes, Myosotis lithospermoìdes, Spermacocce diffusa, Coronilla occidentalis, Bignonia apurensis, Pisonia pubescens, Ruellia viscosa, some new species of Jussieua, and a new genus of the composite family, approximating to Rolandra, the Trichospira mentholdes of M. Kunth.

[^244]:    * M. Latreille has discovered that the mosquitos of South Carolina are of the genus Simulium (Atractocera meigen.)
    $\dagger$ The latter (Crax pauxi) is less common than the former.
    $\pm$ Not quite so broad as the Seine at the Pont Royal, opposite the

[^245]:    palace of the Tuileries, and a little more than half the width of the Thames at Westminster Bridge.

    * This name alludes, no doubt, to the expedition of Antonio Sedeno. The port of Caycara, opposite Cabruta, still bears the name of that Conquistador.

[^246]:    * Tepu-pano, 'place of stones,' in which we recognize tepu 'stone, rock,' as in tepu-iri ' mountain.' We here perceive that Lesgian OigourTartar root tep 'stone' (found in America among the Americans, in teptl; among the Caribs, in tebou; among the Tamanacs, in tepuiri); a striking analogy between the languages of Caucasus and Upper Asia and those of the banks of the Orinoco.
    + In Captain Tuckey's Voyage on the river Congo, we find represented a granitic rock, Taddi Enzazi, which bears a striking resemblance to the mountain of Encaramada.

[^247]:    - All the Missions of South America have names composed of two words, the first of which is necessarily the name of a saint, the patron of the church, and the second an Indian name, that of the nation, or the spot where the establishment is placed. Thus we say, San Jose de Maypures, Santa Cruz de Cachipo, San Juan Nepomuceno de los Atures, \&c. These compound names appear only in official documents; the inhabitants adopt but one of the two names, and generally, provided it be sonorous, the Indian. As the names of saints are several times repeated in neighbouring places, great confusion in geography arises from these repetitions. The names of San Juan, San Diego, and San Pedro,

[^248]:    * The Mapoyes, Parecas, Javaranas, and Curacicanas, who possess fine plantations (conucos) in the savannahs by which these forests are bounded.
    + Between Encarmada and the Rio Manapiare, Don Miguel Sanchez, chief of this little expedition, crossed the Rio Guainaima, which flows into the Cuchivero. Sanchez died, from the fatigue of this journey, on the borders of the Ventuari.
    $\ddagger$ The companion of Diego Ordaz.
    II Thus tin is found in granite of recent formation, at Geyer ; in hyalomicte or graisen, at Zinnwald ; and in syenitic porphyry, at Altenberg, in Saxony, as well as near Naila, in the Fichtelgebirge. I have also seen, in the Upper Palatinate, micaceous iron, and black earthy cobalt, far from any kind of vein, disseminated in a granite destitute of mica, as magnetic iron-sand is in volcanic rocks.

[^249]:    * This word belongs to the Maypure language, and must not be confounded with arua, which means a crocodile, among the Tamanacs, neighbours of the Maypures. The Ottomacs call the turtle of Uruana, achea; the Tamanacs, peje.

[^250]:    *The Tamanac Indians give it the name of carapa; the Maypures call it timi.

[^251]:    *The arraus, which lay their eggs before the beginning of March, (for in the same species the more or less frequent basking in the sun, the food, and the peculia organization of each individual, occasion differences,) come out of the water with the terekays, which lay in January and February. Father Gumilla believes them to be arraus that were not able to lay their eggs the preceding year. It is difficult to find the eggs of the terekays, because these animals, far from collecting in thousands on the same beach, deposit their eggs as they are scattered about.

[^252]:    * In the Tamanac language, from peje, a tortoise, and canepo, rain.

[^253]:    * Properly anoto. This word belongs to the Tamanac Indians. The Maypures call it majepa. The Spanish missionaries say onotarse, 'to rob the skin with anato.'
    + The word bixa, adopted by botanists, is derived from the ancient language of Hayti (the island of St. Domingo). Rocou, the term commonly used by the French, is derived from the Brazilian word, uruou.

[^254]:    * Or Guaypufiaves; they call themselves Uipuñani.
    $t$ In the Missions, the priest's house bears the name of 'the convent.'

[^255]:    * Ropes made with the petioles of a palm-tree with pinnate leaves.

[^256]:    - The pulp of the anato, and even the chica, are astringent and slightly purgative.
    $\pm$ The Caribs, the Salives, the Tamanace, and the Maypures.
    $\ddagger$ The half-clad nations of the temperate zone often paint their shin of the same colour as that with which their clothes are dyed.

[^257]:    * The black and caustic pigment of the caruto (Genipa americana) however, resists a long time the action of water, as we found with regret, having one day, in sport with the Indians, caused our faces to be marked with spots and strokes of caruto. When we returned to Angostura, in the midst of Europeans, these marks were still visible.
    + A word of the Caribbean language. The perisoma of the Indiens of the Orinoco is rather a band than an apron.

[^258]:    *- For instance, the Macos and the Piraoas. The Caribs must be excepted, whose perizoma is a cotton cloth, so broad that it might cover the shoulders.
    $\dagger$.These came originally from the banks of the Inirida, one of the rivers that fall into the Guaviare.

[^259]:    * Intrenchment of monachal despotism.

[^260]:    * These are the words of an inscription, which attests that sounds were heard on the 13th of the month Pachon, in the tenth year of the reign of Antoninus. See Monuments de l'Egypte Ancienne.

[^261]:    * I find the word written GuajiVos, Guahivos, and Guayivos. They call themselves Gua-iva.
    $\dagger$ East of Labranza Grande, and the north-west of Pore, now the tapital of the province of Casanare.

[^262]:    - I remarked the same phenomenon from spongy grains of platina one or two lines in length, collected at the stream-works of Taddo, in the province of Choco. Having been wrapped up in white paper during a journey of several months, they left a black stain, like that of plumbago or supercarburetted iron.

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[^264]:    *Rhopalas, which characterise the vegetation of the Llanos.

[^265]:    * Lucan, Pharsalia, lib. x, v. 132.

[^266]:    * Nat. Quæst., lib. iv, cap. 2. (edit. Elzev., tom. ii, p. 609.)
    + The corresponding terms in use among the people of South America, re saltos, chorros, pongos, cachoeiras, and raudales.

[^267]:    - I have placed in a parenthesis, a literal version of the term employed by Aristotle, to express in reality what we now term the matter of heat. Theodore of Gaza, in his Latin transtation, expresses in the shape of a doubt what Aristotie positively asserts. 1 may here remark, that, notwithstanding the imperfect state of acience among the ancients, the works of the Stagirite contain more ingenious observations than those of many later philosophers. It is in vain we look in Aristoxenes (De Musica), in Theophylactus Simocatta (De Quæstionibus physicis), or in the 5th Book of the Qusest. Nat. of Seneca, for an explanation of the nocturnal augmentation of sound.

[^268]:    * The whole of the features-the expression of the physiognomy; but not the forehead.

[^269]:    * Que le han parecido los zancudos de nocle? Como stamos hoy de mosquitos?

[^270]:    * Generally called 'black waters' (aguas negras). $\dagger$ "Yo tengo mis veinte años de mosquitos."

[^271]:    *The mosquito bovo or tenbiguài; the melero, which always settles upon the eyes; the tempranero, or putchiki; the jejen; the gnat rivau; the great zancudo, or matchaki; the cafafi, \&c.
    $\dagger$ Culex pipiens. This difference between mosquito (little fly,-simulium) and zancudo (gnat,-culex) exists in all the Spanish colonies. The word zancudo signifies 'longlegs,'-qui tiene las zancas largas. The mosquitos of the Orinoco are the moustiques; the zancudos are the maringouins of French travellers.

[^272]:    * 'Which appear at an early hour' (temprano). Some persons say, that the sancudo is the same as the tempranero, which returns at night, after hiding itself for som etime. I have doubts of this identity of the species; the pain caused by the sting of the two insects appeared to me different.
    $\dagger$ By the extreme regularity of the horary variations of the atmospheric pressure.

[^273]:    *The Culex pipiens of Europe does not, like the culex of the torrid zone, shun mountainous places. Giesecke suffered from these insects in Greenland, at Disco, in latitude $70^{\circ}$. They are found in Lapland in summer, at three or four hundred toises high, and at a temperature of $11^{\circ}$ or $12^{\circ}$.

[^274]:    * Trifling modifications in the waters, or in the air, often appear to prevent the development of the mosquitos. Mr. Bowdich remarks that there are none at Coomassie, in the kingdom of the Ashantees, though the town is surrounded by marshes, and though the thermometer keeps up between seventeen and twenty-eight centesimal degrees, day and night.
    + Mas moscas que aire.

[^275]:    * This voracity, this appetite for blood, seems surprising in little insects, that lize on vegetable juices, and in a country almost entirely uninhabited. "What would these animals eat, if we did not pass this way ?' say the Creoles, in going through countries where there are only crocodiles covered with a scaly skin, and hairy monkeys.

[^276]:    - It is sufficient to mention, that the cabic foot contains 2,985,984 cubic lines.

[^277]:    * Literally, ' the eaters,' or ' the devourers.'
    + There are some at Popayan (height 910 toises; mean temperature $18 \cdot 7^{\circ}$ ), but they are species that gnaw wood only.

[^278]:    * Anaveni, Mataveni, Maraveni, \&c.
    + Or Parenas, who must not be confounded either with the Paravenes of the Rio Caura (Caulin, p. 69), or with the Parecas, whose language belongs to the great family of the Tamanac tongues. A young Indian of Maypures, who called himself a Paragini, answered my questions almost in the same words that M. Bonpland heard from a Pareni. I have indicated the differences in the table, see pp. 303-4.
    $\ddagger$ South of the Rio Zama. We slept in the open air near the mouth of the Mataveni on the 28th day of May, in our return from the Rio Negro.

[^279]:    * Of siliceous limestone, at Pique, on the Great Miami ; of sandstone at Creek Point, ten leagues from Chillakothe, where the wall is fifteen hundred toises long.
    + This is the ancient name of the empire of the Zaques, founded by Bochica or Idacanzas, the high priest of Iraca, in New Grenada.

[^280]:    - From them the name of Montserrat is derived, Monte Serrato signifying a mountain ridged or jagged like a saw.

[^281]:    - Rays, on account of the pretended analogy with the fish of this name, the mouth of which seems as if forced downwards below the body. This singular legend has been spread far and wide over the earth. Shakespeare has described Othello as recounting marrellous tales
    " of cannibals that do each other eat : Of Anthropophagi, and men whose heads Do grow beneath their shoulders."

[^282]:    *The diminutive of the Spanish word canela, which signifies cinnamon.

[^283]:    * The dawn : in French aube (alba, albente coelo.)

[^284]:    * The savage tribes designate every commercial nation of Europe by surnames, the origin of which appears altogether accidental. The Spaniards were called 'clothed men,' Pongheme or Uavemi, by way of distinction.

[^285]:    * The rock and little cascades.
    $\dagger$ Bombax ceiba.

[^286]:    *These two words belong to the Poimisano and Paragini tongues.

[^287]:    * Those dolphins that enter the mouth of the Nile, did not escape the observation of the ancients. In a bust in syenite, preserved in the museum at Paris, the sculptor has represented them half concealed in the undulatory beard of the god of the river.

[^288]:    * Literally, ' the ploughers.'

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[^290]:    *This is a new species of the genus taligalea of Aublet. On the same spot grow the Bignonia magnoliæfolia, B. jasminifolia, Solanum topiro, Justicia pectoralis, Faramea cymosa, Piper javitense, Scleria hirtella, Echites javitensis, Lindsea javitensis, and that curious plant of the family of the verbenaceæ, which I have dedicated to the illustrious Leopold von Buch, in whose early labours I participated.

[^291]:    *Thus, at five or six inches depth, between the roots of the Hymenea courbaril, masses of the resin anime (erroneously called copal) are discovered, and are sometimes mistaken for amber in inland places. This phenomenon seems to throw some light on the origin of those large masses of amber which are picked up from time to time on the coast of Pruasia.

    + The pellicles deposited by the milk of heavea, in contact with the atmospheric oxygen, become brown on exposure to the sun. If the dapicho grow black as it is softened before the fire, it is owing to a slight combustion, to a change in the proportion of its elements. I am surprised that eome chemists consider the black caoutchouc of commerce as being mixed with soot, blackened by the smoke to which it has been exposed.

[^292]:    - We saw in Guiana, besides the jacio and the curvana, two other trees that yield caoutchouc in abundance; on the banks of the Atabapo, the guamagui with jatropha leaves, and at Maypures the cime.
    $\dagger$ "With white and rational people." European self-love usually opposes the gente de razon to the gente parda, or coloured people.

[^293]:    * This is a mikania, which was confounded for some time in Europe with the ayapana. De Candolle thinks that the guaco may be the Eupatorium satureisefolium of Lamarck; but this Eupatorium differs by its lineary leaves, while the Mikania guaco has triangular, oval, and very large leaves.
    $\dagger$ Ophioxylon serpentinum.
    $\ddagger$ I shall mention as examples of these nine families; Aristolochia anguicida, Cerbera thevetia, Ophoiorhiza mungos, Polygala senega, Nicotiana tabacum, (one of the remedies most used in Spanish America). Mikanua guaco, Hibiscus abelmoschus (the seeds of which are very active), Lanpujum rumphii, and Kunthia montana (Cafia de la Vibora).

[^294]:    * North of Morocote, at the eastern declivity of the Cordilleas of New Grenada. The salt of the coasts, which the Indians call yuquira, costs two piastres the almuda at San Carlos.

[^295]:    * This na me is given in the Spanish colonies to very different species. The Coluber mapanare of the province of Caracas has one hundred and forty-two ventral plates, and thirty-eight double caudal scales. The Coluber mapanare of the Rio Magdalena has two hundred and eight ventral plates, and sixty-four double caudal scales.

[^296]:    * The hunters connected with military posts, and dependent on the Russian Company, of which the principal shareholders live at Irkutsk. In 1804 the little fortress (krepost) at the bay of Jakutal was still six bundred leagues distant from the most northern Mexican passessions.

[^297]:    * The geological constitution of the soil seems to indicate that, not withstanding the actual difference of level in their waters, the Black Sea, the Caspian, and lake Aral, communicated with each other in an era anterior to historic times. The overflowing of the Aral into the Caspian Sea seems even to be partly of a more recent date, and independent of the bifurcation of the Gihon (Oxus), on which one of the most learned geographers of our day, M. Ritter, has thrown new light.

[^298]:    * The swellings of the Nile take place much later than those of the Orinoco; after the summer solstice, below Syene; and at Cairo in the beginning of July. The Nile begins to sink near that city generally about the 15 th of October, and continues sinking till the 20th of May.

[^299]:    * Aqui, Aqqui, Ake, of the most recent maps.
    + Tomui, Temujo, Tomon.

[^300]:    * 26 Jan. 1523 ; and 10 Oct. 1618.

[^301]:    * At San Carlos there is still preserved an instrument of music, a kind of large drum, ornamented with very rude Indian paintinge, which relate to the exploits of Cocuy.

[^302]:    * The price of a cylinder two inches long is from twelve to fifteen piastres.

[^303]:    the nephritic colic and epilepsy, from their fathers, who received them from the women without husbands."
    *The term el dorado, which signifies the gilded, was not originally the name of the country. The territory subsequently distinguished by that appellation was at first known as the country of "el Rey Dorado" (the Gilded King).

[^304]:    * Signifying apostolic conquests or conversions.

[^305]:    * Two Spanish words, which, according to a Latin form, denote a forest of palm-trees (palmetum) and of pines (pinetum).

[^306]:    * The Sierra de la Parime, or of the Upper Orinoco, and the Sierra (or Campos) dos Parecis, are part of the mountains of Matto Grosso, and form the northern back of the Sierra de Chiquitos. I here name the two chains of mountains running from east to west, and bordering the plains or basins of the Cassiquiare, the Rio Negro, and the Amazon, between $5^{\circ} 30^{\prime}$ north, and $14^{\circ}$ south latitude.
    $\dagger$ This physiognomy struck us forcibly, in the vast forests of Spanish Guiana, only between the second and third degrees of north latitudes,

[^307]:    * The Rios Guajavaca, Moreje, and Cachevaynery.

[^308]:    - En el monte. The Indians born in the missions are distinguished from those born in the woods. The word monte signifies more.frequently, in the colonies, a forest (bosque) than a mountain, and this circumstance has led to great errors in our maps, on which chains of mountains (sierras) are figured, where there are only thick forests, (monte espeso.)

[^309]:    * Some casual instances of children carried off by the negroes in the island of Cuba have led to the belief, in the Spanish colonies, that there are tribes of cannibals in Africa. This opinion, though supported by some travellers, is not borne out by the researches of Mr. Barrow on the interior of that country. Superstitious practices may have given rise to imputations perhaps as unjust as those of which Jewish families were the victims in the ages of intolerance and persecution.
    $\dagger$ See Geraldini Itinerarium, p. 186, and the eloquent tract of cardinal Bembo on the discoveries of Columbus. "Insularum partem homines

[^310]:    * "Quando io mirando Padre, Padre me diciendo."
    + The Quichua or Inca language (Lengua del Inga).
    $\ddagger$ M. Bonpland found at Mandavaca, in the huts of the natives, a plant with tuberous roots, exactly like cassava (yucca). It is called cumapana, and is cooked by being baked on the ashes. It grows spontaneously on the banks of the Cassiquiare.

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[^311]:    - "It is going to rain, because we hear the murmur of the torrents mearer, ${ }^{3 \prime}$ say the mountaineers of the Alps, like those of the Andes. The casse of the phenomenon is a modification of the atmosphere, which has an influence at once on the sonorous and on the huminous undulations. The prognostic drawn from the increase and the intensity of sound in intimately connected with the prognostic drawn from a less extinction of light. The mountaineers predict a change of weather, when, the air being calm, the Alps covered with perpetual snow seem on a sudden to be nearer the observer, and their outlines are marked with great distinctness on the azore sky. What is it that cannes the want of homogencity in tho vertinal streta of the atmouphere to disappear instantaneoushy?

[^312]:    * Simia chiropotes.

[^313]:    * See Views of Nature, p. 195.

[^314]:    - Tropa de rescate; from rescatar, to redeem.
    `† "I Guipunavi avventizj abitatori dell’ Alto Orinoco, recavan de", danni incredibili alle vicine mansuete nazioni ; altre mangiondone, altre conducendone schiave ne' Portoghesi dominj."-"The Guipunaves, at their first arrival on the Upper Orinoco, inflicted incredible injuries on the other peaceable tribes who dwelt near them, devouring some, and selling others as slaves to the Portuguese." (Giili, tom. i, p. 31.)

[^315]:    * On the 15th of October, 1774. La Condamine quitted the town of Grand Para December the 29th, 1743 ; it follows, from a comparison of the dates, that the Indian woman of Pararuma, carried off by the Portuguese, and to whom the French traveller had spolen, had not come with Father Roman, as was erroneously affirmed. The appearance of this woman on the banks of the Amazon is interesting with respect to the researches lately made on the mixture of races and languages: it proves the enormous distances through which the individuals of one tribe are compelled to carry on intercourse with those of another.
    $\dagger$ The intelligence was communicated to him by Father John Ferreyro, rector of the college of Jesuits at Para. (Voy. à l'Amazone, p. 120. Mem. de l'Acad. 1745, p. 450. Caulin, p. 79.) See also, in the work of Gili, the fifth chapter of the first book, published in 1780, with the title: "Della scoperta delle communicazione dell' Orinoco col Maragnone."

[^316]:    * "Estos mosquitos que llaman zancudos gritones los parece cria la naturaleza para castigo y tormento de los hombres."-"Those mosquitos which are called buzzing zapcudos, Nature seems to have created for the especial paniebmentand borture of man." (Fray Pedro Simon.)

[^317]:    * In Tamanac marana; in Maypure, meccuri.

[^318]:    * I may here insert the description of the curare or bejuco de Mavacure, taken from a manuscript, yet nnpublished, of my learned fellow-labourer M. Kunth, corresponding member of the Institute. " Ramuli lignosi, oppositi, ramulo altero abortivo, teretiusculi, fuscescenti-tomentosi, inter petiolos lineola pilosa notati, gemmula aut processu filiformi (pedunculo?) terminati. Folia opposita, bereviter petiolata, ovato-oblonga, acuminata, intergerrima, reticulato-triplinervia, nervo medio subtus prominente, membranacea, ciliata, utrinque glabra, nervo medio fuscescente-tomentoso, lacte viridia, subtus pallidiora, $1 \frac{1}{\frac{1}{2}}-2 \frac{1}{2}$ pollices longa, 8-9 lineas lata. Petioni lineam longi, tomentosi; inarticulati."

[^319]:    - The nux vomica, the upas tieute, and the bean of St. Ignatius. (Strychnos Ignatia.)

[^320]:    * First obtained by Scheele in the year 1782. Gar-Luseac (to whom we are indebted for the complete analysis of this acid) observes, that it can never become very dangerous to society, because its peculiar smell (that of bitter almonds) betrays its presence, and the facility with which it is decomposed makes it difficult to preserve.
    + Oviedo (Sommario delle Indie Orientali) recommends sea-water as an antidote against vegetable poisons. The people in the missions never fail to assure European travellers, that they have no more to fear from arrows dipped in curare, if they have a little salt in their mouths, than from the electric shocks of the gymnoti, when chewing tobacco. Raleigh recommends as an antidote to the ourari (currare) the juice of garlick. [But later axperimenter have completaly proved that if the poison has once thirly

[^321]:    * According to accounts somewhat vague, th $3 y$ are yellow, very large, and have some similicude to those of the Bombax ceiba. M. Bonpland says, however, in his botanical journal written on the banks of the Rio Negro, "flos violaceus." It was thus the Indians of the river had described to him the colour of the corolla.

[^322]:    * "La tapa del coco de monos."

[^323]:    * The smooth surface of these tubes sufficiently proves that they ara not furnished by a plant of the family of umbelliferex.
    $\dagger$ The caricillo del manati, which grows abundantly on the banks of the Orinoco, attains from eight to ten feet in height.

[^324]:    *These nations, in a still ruder state than the natives of the Orinoco, contented themselves with drying the raw fish in the sun. They made up the fish-paste in the form of bricks, and sometimes mized with it the aromatic seed of paliurus (rhamnus), as in Germany, and some other countries, cummin and fennel-seed are mixed with wheaten bread.

[^325]:    * The pichurim bean is the puchiri of La Condamine, which abounds at the Rio Xingn, a tributary stream of the Amazon, and on the banke of the Hyurubaxy, or Yurubesh, which runs into the Rio Negro. The puchery, or pichurim, which is grated like nutmeg, differs from another aromatic fruit (a laurel ?) known in trade at Grand Para by the names of cucheri, cuchiri, or cravo (clavus) do. Maranhão, and which, on account of its odour, is compared with cloves.

[^326]:    * It is called Raudal de abaxo (Low Cataract), in opposition to the great Raudal de Guaharibos, which is situated higher up toward the east.

[^327]:    * The Amazon also is crossed twice on bridges of wood near its source in the lake Lauricocha; first north of Chavin, and then below the confluence of the Rio Aguamiras. These, the only two bridges that have been thrown over the largest river we yet know, are ealled Pewente de Quivilla, and Puente de Guancaybamiba.
    $\dagger$ The etymology of this name, which is unknown to me, might lead to the knowledge of the spot where tirese stones are found. I have sought in vain the name of Macagua among the numerous tributary streams of the Tacuta, the Mahu, the Rupunury, and the Rio Trombetas.

[^328]:    - The Cumangotos, the Maypures, the Mapojos, and some hordes of the Tamanacs, are also fair, but in a less degree than the tribes $I$ have just named. We may add to this list (which the researches of Sömmering, Blumenbach, and Pritchard, on the varieties of the human species, have rendered so interesting) the Ojes of the Cuchivero, the Boanes (now almost destroyed) of the interior of Brazil, and in the north of America, far from the north-west coast, the Mandans and the Akanas (Walkenaer, Geogr., p. 645. Gili, vol. ii, p. 34. Vater, Amerikan. Sprachen, p. 81. Southey, vol. i, p. 603.) The most tawny, we might almost say the blackest of the American race, are the Otomacs and the Guamos. These have perhaps given rise to the confused notions of American negroes, spread through Europe in the early times of the conquest. (Herrera, Dec. i, lib. 3, cap. 9, vol, i, p. 79. Garcia, Origen de los Americanos, p. 259.) Who are those Negros de Quareca, placed by Gomara, p. 277, in that very isthmus of Panama, whence we received the first absurd tales of an albino American people? In reading with attention the authors of the

[^329]:    * The name Parima, which signifies water, great water, is applied sometimes, and more especially, to the land washed by the Rio Parima, or Rio Branco 'Rio de Aguas Blancas), a stream runuing into the Rio Negro; sometimes to the mountains (Sierra Parima), which divide the Upper and Lower Orinoco.

[^330]:    * This frequency of large jaguars is somewhat remarkable in a country destitute of cattle. The tigers of the Upper Orinoco are far less bountifully supplied with prey than those of the Pampas of Buenos Ayres and the Llanos of Caracas, which are covered with herds of cattle. More than four thousand jaguars are killed annually in the Spanish colonies, several of them equalling the mean size of the royal tiger of Asia. Two thousand skins of jaguars were formerly exported annually from Buenos Ayres alone.
    $\uparrow$ Gmelin, in his 'Synonyma,' seems to confound this animal, under the name of Felis discolor, with the great American lion, (Felis concolor,) which is very different from the puma of the Andes of Quito

[^331]:    * They form a quadrilateral plot of a thousand square leagues, the opposite sides of which have contrary slopes, the Cassiquiare flowing towards the south, the Atabapo towards the north, the Orinoco towards the north-west, and the Rio Negro towards the south-east.

[^332]:    * In Tamanac, tepumereme. (Tepu, a stone, rock; as in Mexican, tetl, a stone, and tepetl, a mountain; in Turco-Tatarian, tepe.) The Spanish Americans also call the rock covered with sculptured figures, piedras pintadas; those for instance, which are found on the summit of the Paramo of Guanacas, in New Grenada, and which recall to mind the tepumereme of the Orinoco, the Cassiquiare, and the Rupunuvini.
    $\dagger$ In the Mountains of the Tyrant, (Cerros del Tirano.)

[^333]:    $\dagger$ The Atonatiuh of the Mexicans, the fourth age, the fourth regeneration of the world.

[^334]:    * The geographical distribution of these plants is extremely singular. Scarcely any are found on the eastern coast of Brazil. (See, the interesting work of Prince Maximilian of Neuwied, "Reise nach Brasilien," vol. i. p. 274.)

[^335]:    * Not the ourax of Cuvier (Crax pauxi, Linn,), but the Crax alector.

[^336]:    * I saw no vein, no hole (four) filled with crystals. The decomposition of granitic rocks, and their separation into large masses, dispersed in the plains and valleys in the form of blocks and balls with concentric layers, appear to favour the enlarging of these natural excavations, which resemble real caverus.

[^337]:    * Mummies and skeletons contained in baskets were recently discovered in a cavern in the United States. It is believed, they belong to a race of men analogous to that of the Sandwich Islands. The description of these tombs has some similitude with that of the tombs of Ataruipe.

[^338]:    * The rein-deer are not domesticated in Greenland as they are in Lapland; and the Esquimaux care little for their milk. The bisons taken very young, accustom themselves, on the west of the Alleghanies, to graze with herds of European cows. The females in some districts of India gield a little milk, but the natives have never thought of milking them. What is the origin of that fubulous story related by Gomara (chap. 43, p. 36). according to which the first Spanish navigators saw, on the coast of South Carolina, "stags led to the savannahs by herdsmen ?" The female bisons, according to Mr. Buchanan and the philosophical historian of the Indian Archipelago, Mr. Crawford, yield more milk than common cows.

[^339]:    * In South America, as in Egypt and Nubia, the swelling of the rivers, which occurs periodically in every part of the torrid zone, is erroneously attributed to the melting of the snows.

[^340]:    * This steinbutter must not be confounded with the mountain lutter (bergbutter), which is a saline substance, produced by a deccomposition of aluminous schists.

[^341]:    * Bucaro (vas fictile odoriferum). People are fond of drinking out of these vessels on account of the smell of the clay. The women of the province of Alentejo acquire a habit of masticating the bucaro earth; and feel a great privation when they cannot indulge this vitiated taste.

[^342]:    * Of the genus Inga.
    † Gumilla, vol. ii, p. 260.
    $\ddagger$ It is an acacia with very delicate leaves, and not an Inga. We brought home another species of mimusacea (the chiga of the Ottomacs, and the sepa of the Maypures), that yields seeds, the flour of which is eaten at Uruana like cassava. From this flour the chiga bread is prepared, which is so common at Cunariche, and on the banks of the Lower

[^343]:    *The word tobacco (tabacco), like the words savannah, maize, cacique, maguey (agave), aud manati, belongs to the ancient language of Hayti, or St. Domingo. It did not properly denote the herb, but the tube through which the smoke was inhaled. It seems surprising, that a vegetable production so universally spread should have different names among neighbouring people. The pete-ma of the Omaguas is, no doubt, the pety of the Guaranos; but the analogy between the Cabre and Algonkin (or Lenni-Lenape) words, whicb denote tobacco, may be merely accidental. The following are the synonymes in thirteen languages.

    North America. Aztec or Mexican ; yetl: Algonkin; sema: Huron; oyngoua.

    South America. Peruvian or Quichua; sayri: Chiquito; pâis: Guarany ; pety: Vilela; tusup: Mbaja, (west of the Paraguay) nalodagadi : Moxo (between the Rio Ucayale and the Rio Madeira) sabare: Omagua; petema; Tamanac ; cavai: Maypure; jema: Cabre; scema.

[^344]:    * Nicotiana tabacum, N. rustica, N. paniculata, and N. glutinosa.
    + The Spaniards became acquainted with tobacco in the West India Islands at the end of the l5th century. I have already mentioned that the cultivation of this narcotic plant preceded the cultivation of the

[^345]:    * See, on the Mexican techichi, and on the numerous difficulties that

[^346]:    occur in the history of mute dogs, and dogs destitute of hair, the " Views of Nature," Bohn's edition, p. 85.
    *They sit down in a circle; one of them begins to howl alone, and the others follow in the same tone. The groups of alouate monkeys howl in the same manner, and among them the Indians distinguish "the leader of the band." It was the practice at Mexico to castrate the mute dogs, in order to fatten them. This operation must have contributed to alter the organ of the voice.

[^347]:    * I had found, on the 4 th of April, for the Boca del Rio Apure (on the western bank of the Orinoco), the latitude $7^{\circ} 36^{\prime} 30^{\prime \prime}$, the longitude $69^{\circ} 7^{\prime} 30^{\prime \prime}$; on the 8 th of June 1 found, for the Hato del Capuchino (on

[^348]:    * The tyrant after whom these mountains are named is not Lope de Aguirre, but probably, as the name of the neighbouring cove seems to prove, the celebrated conquistador Antonio Sedeno, who, after the expedition of Herrera, sought to penetrate by the Orinoco to the Rio Meta. He was in a state of rebellion against the audiencia of Santo Domingo. I know not how Sedeno came to Caycara; for historians relate that he was poisoned on the bunks of the Rio Tisnado, one of the tributary streams of the Portuguesa.

[^349]:    * A cacique of Cabritu received Alonzo de Herrera at his dwelling, on the expedition undertaken by Herrera for ascending the Orinoco in 1535.

[^350]:    * I found the latitude of Santo Tomas de la Nueva Guiana, commonly called Angostura, or the Strait, near the cathedral, $8^{\circ} 8^{\prime} 11^{\prime \prime}$, the long. $66^{\circ} 15^{\prime} 21^{\prime \prime}$.

[^351]:    * Artocarpus incisa. Father Andujar, Capuchin missionary of the province of Caracas, zealous in the pursuit of natural history, has introduced the bread-fruit tree from Spanish Guiana at Varinas, and thence into the kingdom of New Grenada. Thus the western coasts of America, washed by the Pacific, receive from the English settlements in the West Indies a production of the Friendly Islands.

[^352]:    * Europe has learnt the existence of the town of Angostura by the trade carried on by the Catalonians in the Carony bark, which is the beneficial bark of the Bonplanda trifoliata. This bark, coming from Nueva Guiana, was called cortesa or cascarilla del Angostura (Cortex Angostura). Botanists so little guessed the origin of this geographical denomination that they began by writing Augustura, and then Augusta.
    $\dagger$ Hornblendschiefer.

[^353]:    * Angostura, or Santo Thomé de la Nueva Guayana, in 1768, had only 500 inhabitants. (Caulin, p. 63.) They were numbered in 1780, and the result was 1,513 ( 455 Whites, 449 Blacks, 363 Mulattoes and Zamboes, and 246 Indians). The population in the year 1789, rose to 4,590 ; and in 1800, to 6,600 souls. (Official Lists, MS.) The capital of the English colony of Demerara, the town of Stabroek, the name of which is scarcely known in Europe, is only fifty leagues distant, southeast of the mouths of the Orinoco. It contains, according to Bolingbroke, nearly 10,000 inhabitants.

[^354]:    * The nutritious fecula or medullary flour of the sago-trees is found principally in a group of palms which M. Kunth has distinguished by the name of calamea. It is collected, however, in the Indian Archipelago, as an article of trade, from the trunks of the Cycas revoluta, the Phoenix farinifera, the Corypha umbraculifera, and the Caryota urens. (Ainslie, Materia Medica of Hindostan, Madras, 1813.) The quantity of natritious matter which the real sago-tree of Asia affords (Sagus Rumphii, or Metroxylon sagu, Roxb.) exceeds that which is furnished by any other plant useful to man. One trunk of a tree in its fifteenth year sometimes yields six hundred pounds weight of sago, or meal (for the word sago signifies meal in the dialect of Amboyna). Mr. Crawford, who resided a long time in the Indian Archipelago, calculates that an English acre could contain four hundred and thirty-five sago-trees, which would gield one hundred and twenty thousand five hundred pounds avoirdupois of fecula, or more than eight thousand pounds yearly. (History of the

[^355]:    to establish their aërial cloisters in the country of Treves, in Germany; but the bishops opposed these extravagast and perilous enterprises.
    (Mosheim, Instit. Hist. Eccles., p. 192.) See Humboldt's Views of Nature (Bohn), pages 13, 136.

    * The use of this moriche wine however is not very common. The Guaraons prefer in general a beverage of fermented honey.

[^356]:    * In Asia, the Ganges, the Burrampooter, and the majestic rivers of Indo-China, direct their course towards the equator. The former flow from the temperate to the torrid zone. This circamstance of courses pursuing opposite directions (towards the equator, and towards the temperate climates) has an influence on the period and the height of the risings, on the nature and variety of the productions on the banks of the rivers, on the less or greater activity of trade; and, I may add, from what we know of the nations of Egypt, Meroë, and India, on the progress of civilization along the valleys of the rivers.

[^357]:    * Strabo, lib. 17, p 789. Diod. Sic., lib. 1, c. 5.

[^358]:    * Nearly forty or fifty days after the summer solstice.
    $\dagger$ Nearly eighty or ninety days after the summer solstice.
    $\ddagger$ The figure of water itself is often substituted for that of the Rat (Arvicola) in the Tartar zodiac. The Rat takes the place of Aquarius. (Gaubil, Obs. Mathem., vol. iii, p. 33.)

[^359]:    * Coxcox bears also the denomination of Teo-Cipactli, in which the root god or divine is added to the name of the sign Cipactli. It is the man of the Fourth Age; who, at the fourth destruction of the world (the last renovation of nature), saved himself with his wife, and reached the mountain of Colhuacan. According to the commentator Germanicus, Deucalion was placed in Aquarius; but the three signs of the Fishes, Aquarius, and Capricorn (the Antelope-fish), were heretofore intimately linked together. The animal, which, after having long inhabited the waters, takes the form of an antelope, and climbs the mountains, reminds people, whose restless imagination seizes the most remote similitudes, of the ancient traditions of Menou, of Noah, and of those Deucalions celcbrated among the Scythians and the Thessalians. As the Tartarian and Mexican zodiacs contain the signs of the Monkey and the Tiyer, they, no doubt, originated in the torrid zone. With the Muyscas, inniabitants of New Grenada, the first sign, as in eastern Asia, was that of water, figured by a Frog. It is also remarkable, that the astrological worship of the Muyscas came to the table-land of Bogota from the eastern side, from the plains of San Juan, which extend toward the Guaviare and the Orinoco.
    $\dagger$ Voyage to the Zaire, p. xvii.
    $\ddagger$ Among the rivers of America this is the case with the Rio Negro the Rio Branco, and the Jupura.

[^360]:    * Nearly seventy or eighty days after our winter solstice, which is the gummer solstice of the southern hemisphere.
    中 Tuckey, Maritime Geogr., vol. iv, p. 309. Hippisley, Exped. to

[^361]:    * Founded in 1762. Population in 1797, 657 souls; in 1803, 769 souls. The most populous villages of these missions, Alta Gracia, Cupapui, Santa Rosa de Cura, and Guri, had between 600 and 900 inhabitants in 1797; but in 1818, epidemic fevers diminished the population more than a third, In some missions these diseases have swept away nearly half of the inhabitants.

[^362]:    * Guacipati, Tupuquen, Angel de la Custodia, and Cura, where the military post of the frontiers was stationed in 1800, which had been anciently placed at the confluence of the Cuyuni and the Curumu.
    + Consecrated a bishop for the four parts of the world (obispo para las quarro partes del mundo) by pope Benedict XIII.

[^363]:    * It appears, that the little table-lands between the mountains of Upata, Cumanu, and Tupuquen, are more than one hundred and fifty toises above the level of the sea.
    $\dagger$ El Dorado, that is, el rey 6 hombre dorado. See vol. ii, p. 400.

[^364]:    * I use this expression, perhaps an improper one, to mark a species of philological examination, to which the names of rivers, lakes, mountains, and tribes, must be subjected, in order to discover their identity in a great number of maps. The apparent diversity of names arises partly from the difference of the dialects spoken by one and the same family of people, partly from the imperfection of our European orthography, and from the extreme negligence with which geographers copy one another. We recognize with difficulty the Rio Uaupe in the Guaupe or Guape; the Xië, in the Guaicia; the Raudal de Atures, in Athule; the Caribbees, in the Calinas and Galibis ; the Guaraunos or Uaran, in the Oaraw-its; \&c. It is, however, by similar mutations of letters, that the Spaniards have made hijo of filius; hambre, of fames; and Felipo de Urre, and even Utre, of the Conquistador Philip von Huten; that the Tamanacs in America have substituted choraro for soldado; and the Jews in China, Ialemeiohang for Jeremiah. Analogy and a certain etymological tact must guide geographers in researches of this kind, in which they would be exposed to serious errors, if they were not to study at the same time the respective situations of the upper and lower tributary streams of the same river. Our maps of America are overloaded with names, for which rivers have been created. This desire of compiling, of filling up vacancies, and of employing, without investigation, heterogeneous materials, has given

[^365]:    * El valle del Dorado. Pineda relates, "que mas adelante de la provincia de la Canela se hallan tierras muy ricas, adonde andaban los hombres armados de pieças y joyas de oro, y que no havia sierra, ni montana." [Beyond the province of Canela there are found very rich countries (though without mountains) in which the natives are adorned with trinkets and plates of gold.] Herrera, dec. v, lib. x, cap. xiv, and dec. vi, lib. viii, cap. vi. Geogr. Blaviana, vol. xi, p. 261. Southey, tom i, p. 78 et 373.

[^366]:    * Nufio de Chaves went from the Ciudad de la Asumpcion, situate on the Rio Paraguay, to discover, in the latitude of $24^{\circ}$ south, the vast cmpire of El Dorado, which was everywhere supposed to lie on the eastern back of the Andes.
    + We may be surprised to see, that the expedition of Huten is passed over in absolute silence by Herrera (dec. 7, lib. 10, cap. vii, vol. iv, p. 238). Fray Pedro Simon gives the whole particulars of it, true or fabulous; but he composed his work from materials that were unknown to Herrera.
    $\ddagger$ In 1560 Pedro de Ursua even took the title of Governa!?or del Dorado y de Onagua. (Fray Pedro Simon, vol. vi. chan. x, p. 430.)

[^367]:    * Cayley's Life of Raleigh, vol. i, p. 159, 236, and 283. Masham, in the third voyage of Raleigh (1596), repeats these accounts of the Lake Rupunuwini.

[^368]:    * In Persian, the root water (ab) is found also in lake (abdan). For other etymologies of the words Parima and Manoa, see Gili, vol i, p. 81, and $141^{\text {; }}$; and Gumilla, vol. i, p. 403.

[^369]:    * In Peruvian or Quichua (lengua del Inca) gold is called cori, whence are derived chichicori, gold in powder, and corikoya, gold-ore.

    中 Properly "casado con una sobrina:" (Fray Pedro Simon; p. 597 and 608. Harris, Coll., vol. ii, p. 212. Laet, p. 652. Caulin, p. 175.) Raleigh calts Quesada Cemenes de Casada: He also confounds the periods of the voyages of Ordaz (Ordace), Orellana (Oreliawo); and-Ursua. See Empire of Guiana, p. 13-20.

[^370]:    "No doubt between the Paramos of Chita and of Zoraca, taking the road of Chire and Pore. Berrio told Raleigh, that he came from the Rio Casanare to the: Pato, from the Pate to the Meta, and from the Meta to the Baraguan (Orinoco). We mint not confound this Rio Pato (a name connected no doubt with that of the ancient mission of Patuto) with the Rio Paute.
    $\dagger$ I believe I can demonstrate, that the fable of Juan Martines, spread abroad by the narrative of Raleigh; was founded on the adventures of Juan Martin de Albujar, well known to the Spanish historians of the Conquest ; and who, in the expedition of Pedro de Silva (1570), fell into the bands of the Caribs of the Lower Orinoco. This Albujar married an Indian woman, and became a savage himself, as happens sometimes in our own days on the western limits of Canada and of the United States. After having long wandered with the Caribs, the desire of rejoining the Whites led him by the Rio Essequibo to the island of Trinidad. He made several excursions to Santa Fé de Bogotá, and at length settled at Carora. (Simon, p. 591). I know not whether he died at Porto Rico; but it cannot be doubted, that it was he who learned from the Carib traders the name of the Manoas [of Jarubesh], As be lived on the banks of the Upper Carony, and reappeared by the Rio Essequibo, he may have contributed also, to place the lake Manoa at the isthmus of Ru punuwini. Raleigh makes his Juan Martinez embark below Morequito, a village at the east of that confluence of the Carony with the Orinoco. Thence he makes him dragged by the Caribs from town to town, till he finds at Manoa a relation of the inca Atabalipa (Atahualpa), whom he had known before at Caxamarca, and who had fled before the Spaniards. It appears that Raleigh had forgotten that the voyage of Ordaz (1531) was two years anterior to the death of Atahualpa, and the entire destruction of the empire of Pera 1 He must have confounded the expedition of Ordas with that of Silva ( $\mathbf{1 5 7 0}$ ), in which Jaan Martin de Albuzar partook. The latter, who related his tales at Santa Fé, at Venezueia; and

[^371]:    * Raleigh distinguishes the Meta from the Beta, which flows into the Baraguan (the Orinoco) conjointly with the Daune, near Athule; as he also distinguishes the Casunare, a tributary stream of the Meta, and the Casnero, which comes from the south, and appears to be the Rio Cuchivero. All above the confluence of the Apure was then very confusedly known ; and streams that flow into the tributary streams of the Orinoco, were considered as flowing into this river itself. The Apure (Capuri) and the Meta appeared long to be the same river, on account of their proximity, and the numerous branches by which the Arauca and the Apure join each other. Is the name of Beta perchance connected with

[^372]:    * He died in 1512, as Mr. Muñoz has proved by the documents of the archives of Simancas. (Hist. del Nuevo Mundo, vol. i, p. 17.) Tiraboschi, Storia àlla Litteratura.
    + See the learned researches of M. Walckenaer, in the Bibliographie Univ. vol. vi, p. 209, art. "Buckinck." On the maps added. to Ptolemy in 1506 we find no trace of the discoveries of Columbus.
    $\ddagger$ No doubt the lands between Uucatan, Cape Gracias a Dios, and Veragua, discovered by Columbus (1502 and 1503), by Solis, and by Pinçon (1506).

[^373]:    * See, for instance, Hondius, Nieuwe Caerte van het goudrycke landt Guiana, 1599 ; and Sanson's Map of America, in 1656 and 1669.
    + Brasilia et Caribaua, auct. Hondio et Huelsen, 1599.
    $\ddagger$ I have treated this question in a Memoire sur la fixation des limites de la Guyane Francaise, written at the desire of the Portuguese government during the negotiations of Paris in 1817. (See Schoell, Archives polit., or Pièces inédites, vol. i, p. 48-58.) Ribeyro, in his celebrated map of the world of 1529, places the Rio de Vicente Pinçon south of the Amazon, near the Gulf of Maranhão. This navigator landed at this spot, after having been at Cape Saint Augustin, and before he reached the mouth of the Amazon. (Herrera, dec. I, p. 107.) The narrative of Gomara, Hist. Nat., 1553, p. 48, is very confused in a geographical point of view.
    § Compare the maps of 1599 with those of Sanson (1656) and of Blaeuw (1633).

[^374]:    * Sanson, Course of the Amazon, 1680 ; De L'Isle, Amerique Mérid. 1700. D'Anville, first edition of his 'America,' 1748.

[^375]:    * The fight of Manco-Inca, brother of Atahualpa, to the east of the Cordilleras, no doubt gave rise to the tradition of the new empire of the Incas in Dorado. It was forgotten, that Caxamarca and Cuzco, two towns where the princes of that unfortunate family were at the time of their emigration, are situate to the south of the Amazon, in the latitudes of seven degrees eight minutes, and thirteen degrees twenty-one minutes south, and consequently four hundred leagues south-west of the pretended town of Manoa on the lake Parima, (three degrees and a half noith lat.) It is probable that, from the extreme difficulty of penetrating into the plains east of the Andes, covered with forests, the fugitive princes never went beyond the banks of the Beni. The following is what I learnt with certainty respecting the emigration of the family of the Inca, some sad vestiges of which I saw on passing by Caxamarca. Manco-Inca, acknowledged as the legitimate successor of Atahualpa, made war without

[^376]:    - Messrs. Westewood, Dimocke, and Bulmar.
    $\dagger$ See the defence of Raleigh, in the preface to the Discovery of Guiana, 1596, pp. 2-4.
    $\ddagger$ In the southern branch of this chain, which passes by Yusma, Ville de Cura, and Ocumare, particularly near Buria, Los Teques, and Los Marietas.

[^377]:    * The height of Villa Rica is six hundred and thirty toises; but the great table-land of the Capitania de Minias Geraes is only three hundred toises in height. See the profile which Colonel d'Eschwege has published at Weimar, with an indication of the rocks, in imitation of my profile of the Mexican table-land.
    † The little rivers Cosanga, Quixos, and Papallacta or Maspa, which form the Coca, rise on the eastern slope of the Nevado de Antisana. The Rio Ansupi brings down the largest grains of gold: it flows into the Napo, south of the Archidona, above the mouth of the Misagaalli. Between the Misagualli and the Rio Coca, in the province of Avila, five other northern tributary streams of the Napo (the Siguna, Munino, Suno, Guataracu, and Pucono) are known as being singularly auriferous. These local details are taken from several manuscript reports of the Governor of Quixos, from which I traced the map of the countries east of the Antisana.
    $\ddagger$ From Rio Santiago, a tributary stream of the Upper Marañon, to the Llanos of Caguan and of San Juan.

[^378]:    * "On the north of the confluence of the Curupatuba and the Amazon," says Acunha, " is the mountain of Paraguaxo, which, when illumined by the sun, glows with the most beautiful colours; and thence from time to time issues a horrible noise (revienta con grandes estruenos)." Is there a volcanic phenomenon in this eastern part of the New Continent? or is it the love of the marvellous, which has given rise to the tradition of the bellowings (bramidos) of Paraguaxo? The lustre emitted from the sides of the mountain recalls to mind what we have mentioned above of the miraculous rocks of Calitamini, and the island Ipomucena, in the imaginary Lake Dorado. In one of the Spanish letters intercepted at sea by Captain George Popham, in 1594, it is said, "Having inquired of the natives whence they obtained the spangles and powder of gold, which we found in their huts, and which they stick on their skin by means of some greasy substances, they told us, that in a certain plain, they tore up the grass, and gathered the earth in baskets, to subject it to the process of washing." (Raleigh, p. 109.) Can this passage be explained by supposing that the Indians sought thus laboriously, not for gold, but for spangles of mica, which the natives of Rio Caura still em. ploy as ornaments, when they paint their bodies?

[^379]:    * "Deorum nominibus appellant secretum illud, quod sola reverentia vident."-Tacitus, Germania, IX.

[^380]:    * The Proteacere are not, like the Araucaria, an exclusively southern orm. We found the Rhopala complicata, and the R. obovata, in $2^{\circ} 30^{\prime}$, and in $10^{\circ}$ of north latitude.
    † A neighbouring genus, Byrsonima cocollobæfolia, B. laurifolia, near Matagorda, and B. ropalæfolia.
    $\ddagger$ The moriche, like the Sagus Rumphii, is a palm-tree of the marshes, not a paln-tree of the coast, like the Chamærops humilis, the common cocoa-tree, and the lodoicea.

[^381]:    * Hills made by the hand, or artificial hills.

[^382]:    enim malieres incorruptam antiquitatem conservant, quod multorum sermonis expertes ea tenent semper, quæ prima didicerunt."

    * The following are examples of the difference between the language of the men ( $m$ ), and the women (w); isle, oubao ( $m$ ), acaera (w); man, ouekelli ( $m$ ), eyeri $(w)$; but, irhen ( $m$ ), atica ( $w$ ).

[^383]:    * These names of places can be perpetuated only where the nations succeed immediately to each other, and where the tradition is uninterrupted. Thus, in the province of Quito, many of the summits of the Andes bear names which belong neither to the Quichua (the language of the Inca) oor to the ancient language of the Paruays, governed by the Conchocando of Lican.
    $\dagger$ Vespucci says: "Charaibi magnæ sapientiæ viri."
    $\ddagger$ Crawfurd, Ind. Archipel., vol. ii. p. 371. I make use of the word indigenous (autocthoni), not to indicate a fact of creation, which does not TOL. III.

[^384]:    * Rochefort, Hist. des Antilles, vol. i. pp. 326-353; Garcia, p. 322 ; Robertson, book iii. note 69. The conjecture of Father Gili, that the Caribs of the continent may have come from the islands at the time of the first conquest of the Spaniards (Saggio, vol. iii. p. 204), is at variance with all the statements of the early historians.
    $\dagger$ "La gente de las islas Yucayas era (1492) mas blanca y de major policia que la de Cuba y Haiti. Havia mucha diversidad de lenguas." [The people of the Lucayes were (1492) of fairer complexion and of mare civilized manners than those of Cuba and Haiti. They had a great diversity of languages.] Gomara, Hist. de Ind, fol. xxii.

[^385]:    * These unfortunate remnants of a nation heretofore powerful were banished, in 1795, to the Island of Rattam, in the Bay of Honduras, because they were accused by the English Government of having connexions with the French. In 1760, an able minister, M. Lescallier, proposed to the Court of Versailles to invite the Red and Black Caribs from St. Vincent to Guiana, and to employ them as free men in the cultivation of the land. I doubt whether their number at that period amounted to six thousand, as the island of St. Vincent contained in 1787 not more than fourteen thousand inhabitants of all colours.
    $\dagger$ For instance, the Tapoyranas of Guiana (Barrère, p. 239), the Solkeeks of Upper Louisiana (Walckenaer, Cosmos, p. 583). "Los Indios de Cumana," says Gomara (Hist. de Ind.), "aprietan a los niños la cabeça muy blando, pero mucho, entre dos almohadillas de algodon para ensancharlos la cara, que lo tienen por hermosura. Las donzellas traen senogiles muy apretados por debaxo y encima de las rodillas, para que los maslos y pantorillas engorden mucho." [The Indians of Cumana press down the heads of young infants tightly between cushionsstuffed with cotton, for the purpose of giving width to their faces, which they regard as a beauty. The young girls wear very tight bandages round their knees, in order to give thickness to the thighs and calves of the legs.]
    $\ddagger$ " Edaces humanarum carnium novi helluones anthropophagi, Caribes alias Canibales appellati."

[^386]:    * Among the Hurons (Wyandots) and the Natchez, the succession to the magistracy is continued by the women : it is not the son who succeeds, out the son of the sister, or of the nearest relation in the female line. This mode of succession is said to be the most certain, because the supreme power remains attached to the blood of the last chief; it is a practice that insures legitimacy. Ancient traces of this strange mode of succession, so common in Africa and in the East Indies, exist in the dynasty of the kings of the West India Islands.

[^387]:    * People that came from Florida, or from the south (shavraneu) to the north. $\dagger$ See vol. ii. p. 485.
    $\ddagger$ Epist. lib. viii. ep. 8. "Clitumnus non loci devexitate, sed ipsa sui copia et quasi pondere impellitur."

[^388]:    *Reckoning only that part of the Llanos which is bounded by the Rie Apure on the south, and by the Sierra Nevada de Merida and the Parimo de las Rosas on the west.

[^389]:    * The Spanish words banco and mesa signify literally 'bench' and 'table.' In the Llanos of South America, little elevations rising slightly above the general elevation of the plain are called bancos and mesas, from their supposed resemblance to benches and tables.

[^390]:    * The fan-palm, or sago-tree of Guiana.
    + In calculating from maps on a very large scale, I found the Llanos of Cumana, Barcelona, and Caracas, from the delta of the Orinoco to the northern bank of the Apure, 7,200 square leagues; the Llanos between the Apure and Putumayo, 21,000 leagues; the Pampas on the north-west of Buenos Ayres, $\mathbf{4 0 , 0 0 0}$ square leagues; the Pampas south of the parallel of Buenos Ayres, 37,000 square leagues. The total area of the Llanos of South America, covered with gramina, is consequently 105,200 square leagues, twenty leagues to an equatorial degree.

[^391]:    * Leopold von Buch, Voyage en Norwège, vol. i. p. 30.
    $\dagger$ Are there any isolated blocks in North America northward of the great lakes?

[^392]:    * These observations were made on the Plaza Major, They are merely the result of six circum-meridian heights of Canopus, taken all in one night. In "Las Memorias de Espinosa," the latitude is stated to be $10^{\circ} 9^{\prime} 6^{\prime \prime}$. The result of M. Ferrer's observations made it $10^{\circ} 8^{\prime} 24^{\prime \prime}$.
    + "La milagrosa imagen de Maria Santissima del Socorro," also called "La Virgen del Tutumo."

[^393]:    * The Lecythis ollaria, in the vicinity of Nueva Barcelona, furnishes excellent timber. We saw trunks of this tree seventy feet high. Around the town, beyond that arid zone of cactus which separates Nueva Barcelona from the steppe, grow the Clerodendrum tenuifolium, the Ionidium itubu, which resembles the Viola, and the Allionia violacea.

[^394]:    * Mr. Langsdor (Wetterauisches Journal, pt. i. p. 254) first made known this very extraordinary physiological phenomenon, which I prefer describing in Latin : "Coriæcorum gens, in ora Asiæ septentrioni opposita, potum sibi excogitavit ex succo inebriante agaricı muscarii. Qui succus (æque ut asparagorum), vel per humanum corpus transfusus, temulentiam nihilominus facit. Quare gens misera et inops, quo rarius mentis sit suæ; propriam urinam bibitidentidem : continuoque mingens rursusque hauriens eundem succum (dicas, ne ulla in parte mundi desit ebrietas), pauculis agaricis producere in diem quintum temulentiam potest."

[^395]:    * I have already cescribed the pearls of Araya; its sulphurous deposits. and submarine springs of liquid and colourless petroleum. See vol. $i$, p. 191.

[^396]:    VOL IIT.

[^397]:    * The real is about $6 \frac{1}{2} d$. English.
    + Another place was mentioned to us, west of Bordones, the Puerto Escondido. But that coast appeared to me to be wholly calcareous; and I cannot conceive where could be the situation of ampelite and native alum on this point. Was it in the beds of slaty clay that alternate with the alpine limestone of Cumanacoa? Fibrous alum is found in Europe only in formations posterior to those of transition, in lignites, and other tertiary formations belonging to the lignites.

[^398]:    * Croton argyrophyllus, and C. marginatus.
    $\dagger$ Great Lake, or the Bishop's Lake.
    $\ddagger$ This is a long narrow gulf, three miles from north to south, similar to the fiords of Norway.

[^399]:    * Notwithstanding the political changes which have taken place in the South American colonies, I shall throughout this work designate the country inhabited by the Spanish Americans by the denomination of Spanish America. I call the country of the Anglo-Americans the United States, without adding " of North America," although other United States exist in South America. It is embarrassing to speak of nations who play a great part on the scene of the world, without having collective names. The term "American" can no longer be applied solely to the citizens of the United States of North America; and it were to be wished that the nomenclature of the independent nations of the New Continent should be fixed in a manner at once convenient, harmonious, and precise.

[^400]:    vOL. III.

[^401]:    * The old vice-royalty of Buenos Ayres extended also along a smanl portion of the South Sea coast.

[^402]:    * These two Intendencias contain together 5520 square leagues, and a ative population of 508 inhabitants to the square sea-league.

[^403]:    * The back of the animal is cut in slices of moderate thickness. An ex or cow of the weight of 25 arrobas produces only 4 to 5 arrobas of tasajo or tasso. In 1792, the port of Barcelona atone exported 98,017 arrobas to the island of Cuba. The average price is 14 reals, and varies from 10 to 18 (the real is worth about $6 \frac{1}{2} d$. English). M. Urquinasa estimates the total exportation of Venezuela in 1809, at 200,000 arrobas of tasajo.

[^404]:    * In 1800, a day-labourer (peon) employed in working the ground, gained in the province of Caracas, 15 sous, exclusive of his food. A man who hewed building timber in the forests on the coast of Paria, was paid at Cumana 45 to 50 sous a-day, without his food. A carpenter gained daily from 3 to 6 francs in New Andalusia. Three cakes of cassava (the bread of the country), 21 inches in diameter, $1 \frac{1}{2}$ line thick, and $2 \frac{1}{2} \mathrm{lb}$. weight, cost at Caracas one half-real, or $6 \frac{1}{2}$ sous. A man eats daily not less than 2 sous' worth of cassava, that food being constantly mixed with bananas, dried meat (tasajo), and naselon, or unrefined sugar.

[^405]:    * Christopher Columbus, in 1503, named the Cayman Islands " Peñas. cales de las Tortugas," on account of the sea-tortoises which he saw swimming in those latitudes.

[^406]:    * Its area is little less in extent than that of England, not including Wales.
    + These places are brought into communication one with another by a voyage of ten or twelve days.

[^407]:    * Salud signifies Health.

[^408]:    * I also fixed, by direct observations, several positions in the interior of the island of Cuba : viz. Rio Blanco, a plantation of Count Jaruco y Mopex;

[^409]:    the Almirante, a plantation of the Countess Auenavista; San Antonio de Beitia; the village of Managua; San Antonio de Bareto; and the Fondadero, near the town of San Antonio de los Banos.

[^410]:    * I saw neither gryphites, nor ammonites of Jura limestone, nor the nummulites and cerites of coarse limestone.
    $\dagger$ The western part of the island has no deep ravines ; and we recognize this alternation in travelling from the Havannah to Batabano, the deepest beds (inclined from $30^{\circ}$ to $40^{\circ}$ N.E.) appear as we advance.
    $\ddagger$ Sandstone and ferruginous sand; iron-sand?

[^411]:    * M. Moreau de Jonnès has well distinguished, in his Histoire physique des Antilles Françoises, between the "Roche à ravets" of Martinique and Hayti, which is porous, filled with terebratulites, and other vestiges of sea-shells, somewhat analagous to the limestone of Guines and the calcareous pelagic sediment called at Guadaloupe "Platine," or "Maçonne bon Dieu." In the "cayos" of the island of Cuba, or "Jardinillos del Rey y del Reyna," the whole coral rock lying above the surface of the water, appeared to me to be fragmentary, that is, composed of broken blocks. It is, however, probable, that in the depth it reposes on masses of polypi still living.
    $\dagger$ The surface of these shelves, blackened and excavated by the waters, presents ramifications like the cauliflower, as they are observed on the carrents of lava. Is the change of colour produced by the waters owing

[^412]:    * Does there exist in the Bay of the Havannah, any other source of petroleum than that of Guanabacoa, or must it be admitted that the "betun liquido," which in 1508 was employed by Sebastian de Ocampo for the caulking of ships, is dried up ? That spring, however, fixed the attention of Ocampo on the port of the Havannah, where he gave it the name of Puerto de Carenas. It is said that abundant springs of petroleum are also found in the eastern part of the island (Manantialis de betun y chapapote) between Holguin and Mayari, and on the coast of Santiago de Cuba.
    - On a serpentine that flows like a penombre, veins of greenstone (diorite), near Lake Clunie, in Perthshire. See MacGulloch, in Edinb. Journ. of Science, 1824, July, pp. 3-16. On a vein of serpentine, and the alterations it produces on the banks of Carity, near West-Balloch in Forfarshire, see Charles Lyell, l. c., vol. iii., p. 43.

[^413]:    * The best informed inhabitents of the island assert, that the cultivated orange-trees brought from Asia, preserve the size, and all the properties of their fruits, when they become wild. The Brazilians affirm that the small bitter orange which bears the name of "loranja do terra," and is found wild, far from the habitations of man, is of American origin. (Caldeleugh, Travels in South America.)

[^414]:    * Oreodoxa regia.

[^415]:    * This striking analogy was ascertained by M. Geoffroy de SaintHilaire in 1803, when General Rochambeau sent a crocodile from San Domingo to the Museum of Natural History at Paris. M. Bonpland and myself had made drawings and detailed descriptions in 1801 and 1802, of the same species which inhabit the great rivers of South America, during our passage on the Apure, the Orinoco, and the Magdalena. We committed the mistake so common to travellers, of not sending them at once to Europe, together with some young specimens.
    + M. Descourtils, who knows the habits of the crocodile better than any other author who has written on that reptile, saw, like Dampier and myself, the Crocodilus acutus often touch his tail with his mouth.

[^416]:    * The four bags filled with musk (bolzas del almizcle) are, in the crocodile of Batabano, exactly in the same position as in that of the Rio Magdalena, beneath the lower jaw and near the anus. I was much surprised at not perceiving the smell of musk at the Havannah, three days after the death of the animal, in a temperature of $30^{\circ}$, while at Mompox, on the banks of the Magdalena, living crocodiles infected our apartment. I have since found, that Dampier also remarked " an absence of smell in the crocodile of Cuba, where the caymans spread a very strong smell of musk."
    $\dagger$ Crocodilus acutus of San Domingo. Alligator lucius of Florida anr. the Mississippi.

[^417]:    * There exists great geographical confusion, even at the Havannah, in reference to the ancient denominations of the Jardines del Rey and Jardines de la Reyna. In the description of the island of Cuba, given in the Mercurio Americano, and in the Historia Natural de la Isla de Cuba, published at the, Havannah by Don Antonio Lopez Gomez, the two groups are placed on the southern coast of the island. Lopez says that the Jardines del Rey extend from the Laguna de Cortez to Bahia de Xagua; but it is historically certain that the governor Diego Velasquez gave his name to the western part of the chain of rocks of the Old Chanuel, between Cayo Frances and Le Monillo, on the northern coast of the island of Cuba. The Jardines de la Reyna, situated between Cabo Cruz and the port of the Trinity, are in no manner connected with the Jardines and Jardinillos of the Isla de Pinos. Between the two groups of the chain of rocks are the fiats (placeres) of La Paz and Xagua.

[^418]:    *To the sucet or guaican of the natives of Cuba, the Spaniards have given the characteristic name of revès, that is, "placed on its back, or reversed." In fact, at first sight, the position of the back and the abdomen is confounded. Anghiera says: "Nostrates reversum appellant, quia versus venatur." I examined a remora of the South Sea during the passage from Lima to Acapulco. As he lived a long time out of the water, I tried experiments on the weight he could carry before the blades of the disk loosened from the plank to which the animal was fixed; but

[^419]:    * "The Gulf-stream, between the Bahamas and Florida, is very little wider than Behring's Strait; and yet the water rushing through this passage is of sufficient force and quantity to put the whole Northern Atlantic in motion, and to make its influence be felt in the distant strait of Gibraltar and on the more distant coast of Africa."-(Quarterly Rev., February, 1818.)
    $\dagger$ I do not pretend to explain, by the same causes, the great phenomean of the coast of Sweden, where the sea has, on some points, the appearance of a very unequal lowering of from three to five feet in one hundred years. The great geologist, Leopold von Buch, has imparted new interest to these observations, by examining whether it be not rather some parts of the contiment of Scandinavia which insensibly heaves up. An analogous supposition was entertained by the inhabitants of Dutch Guiana.

[^420]:    * Compare the Lettera rarissima di Christoforo Colombo, di 7 di Julio, 1503; with the letter of Herrera, dated Dec. 1. Nothing can be more touching and pathetic than the expression of melancholy which prevails in the letter of Columbus, written at Jamaica, and addressed to King Ferdinand and Queen Isabella. I recommend to the notice of those who wish to understand the character of that extraordinary man, the recital of the nocturnal vision, in which he imagined that he heard a celestial voice, in the midst of a tempest, encouraging him by these words: "Iddio maravigliosamente fece sonar tuo nome nella terra. Le Indie que sono parte del mondo cosi ricca, te le ha date per tue; tu le hai repartite dove ti è piaciuto, e ti dette potenzia per farlo. Delli ligamenti del mare Oceano che erano serrati con catene cosi forte, ti donò le chiave," \&c. [God marvellously makes thy name resound throughout the world. The Indies, which are so rich a portion of the world, he gives to thee for thyself; thou mayest distribute them in the way thou pleasest, and God gives thee power to do so. Of the shores of the Atlantic, which were closed by such strong chains, be gives thee the key.] This fragment has been handed down to us only in an ancient Italian tradition; for the Spanish original mentioned in the Biblioteca Nautica of Don Antonio Leon has not hitherto been found. I may add a few more lines, charac-

[^421]:    - Eruptions of fresh water in the sea, near Baiæ, Syracuse, and Aradus (in Phenicia), were known to the ancients. Strabo, lib. 16, p. 754. The coral islands that surround Radak; especially the low island of Otdia, furnish also fresh water. (Chamisso, in Kotzebue's Entdekkungs-Reise, vol. iii, p. 108.)

[^422]:    * Possibly they subsist upon sea-weed in the ocean, as we saw them feed, on the banks of the Apure and the Orinoco, on several species of Panicum and Oplismenus (camalote?). It appears common eiough, on the coast of Tabasco and Honduras, at the mouths of rivers, to find the manatis swimming in the sea, as crocodiles do sometimes. Dampier distinguishes between the fresh-water and the salt-water manati. (Voyages and Descr., vol. ii.) Among the Cayos de las doce leguas, east of Xagua, some islands bear the name of Meganos del Manati.

[^423]:    * Here the celebrated philanthropist Bartolomeo de las Casas obtained, in 1514, from his friend Velasquez, the governor, a good repartiniente de Indios (grant of land so called). But this he renounced in the same year, from scruples of conscience, during a short stay at Jamaica.

[^424]:    * Corypha miraguama. Probably the same species which struck Messrs. John and William Fraser (father and son), in the vicinity of Matanzas. Those two botanists, who introduced a great number of valuable plants to the gardens of Europe, were shipwrecked on their voyage to the Hapannah from the United States, and saved themselves with difficulty on the cayos at the entrance of the Old Channel, a few weeks before my departure for Carthagena.

[^425]:    * Wherever the rock is visible I perceived compact limestone, whitishgrey, partly porous, and partly with a smooth fracture, as in the Jura formation.
    $\uparrow$ This river flows towards the east into the Bahia de Xagua.
    $\ddagger$ It is questionable whether the town founded by Velasquez was not situated in the plain and nearer the ports of Casilda and Guaurabo. It has been suggested that the fear of the French, Portuguese, and English freebooters, led to the selection, even in inland places, of sites on the declivity of mountains, whence, as from a watch-tower, the approach of the enemy could be discerned; but it seems to me that these fears could have had no existence prior to the government of Hernando de Soto. The Harannah was sacked for the first time, by French corsairs, in 1539.

[^426]:    * Fish-hooks with chains.
    † "Vidimus quoque squales, quotiescunque, hamo icti, dimidia parte corporis e fluctibus extrahebantur, cito alvo stercus emittere haud absimile excrementis caninis. Commovebat intestina (ut arbitramur) subitus pavor." Although the form and number of teeth change with age, and the teeth appear successively in the shark genus, I doubt whether Don Antonio Ulloa be correct in stating that "the young sharks have two, and the old ones four rows of grinders." These, like many other sea-fish, are easily accustomed to live in fresh water, or in water slightly briny. It is observed that sharks (tiburones) abuund of late in the Laguna of Maracaybo, whither they have been attracted by the dead bodies thrown into the water after the frequent battles between the Spanish royalists and the Columbian republicans.

[^427]:    * I found the surface of the Pacific ocean, in the month of October, 1802, on the coast of Truxillo, $15.8^{\circ}$ cent.; in the port of Callao, in November, $15 \cdot 5^{\circ}$; between the parallel of Callao and Punta Parina, in December, $19^{\circ}$; and progressively, when the current advanced towards the.equator, and receded towards the W.N.W., $20.5^{\circ}$ and $22^{\circ} 3^{\circ}$.

[^428]:    * It is composed of the islands Mucara, Ceycen, Maravilla, Tintipan, Panda, Palma, Mangles, and Salamanquilla, which rise little above the sea. Several of them have the form of a bastion. There are two passages in the middle of this archipelago, from seventeen to twenty fathoms. Large vessels can pass between the Isla Panda and Tintipan, and between the Isla de Mangles and Palma.

[^429]:    - As, within the tropics, it takes but little time to collect some inches of water in a vase having a wide opening, and narrowing towards the bottom, I do not think there can be any error in the observation, when the heat of the rain-water differs from that of the air. If the heat of the rain-water be less than that of the air, it may be presumed that only a part of the total effect is observed. I often foond, at Mexico, at the end of June, the rain at $19.2^{\circ}$ or $19.4^{\circ}$, when the air was at $17.8^{\circ}$ and $18^{\circ}$. In general, it appeared to me, that within the torrid zone, either at the level of the sea, or on table-lands from 1200 to 1500 toises high, there is no rain but that during storms, which falls in large drops very distant from each other, and is sensibly colder than the air. These drops bring with them, no doubt, the low temperature of the high regions. In the rain which I found hotter than the air, two causes may act simultaneously. Great clouds heat, by the absorption of the rays of the sun which strike their surface; and the drops of water in falling cause an evaporation, and produce cold in the air. The temperature of rain-water, to which I devoted much attention during my travels, has become a more important problem since M. Boisgiraud, Professor of Experimental Philosophy at Poitiers, has proved, that in Europe rain is generally sufficiently cold, relatively to the air, to cause precipitation of vapour at the surface of every drop. From this fact he traces the cause of the unequal quantity of rain collected at different heights. When we recollect that one degree only of cooling precipitates more water in the hot climate of the tropics, than by a temperature of $10^{\circ}$ to $13^{\circ}$, we may cease to be surprised at the

[^430]:    * Cronica del Peru, pp. 21, 22. The Indıans of Darien, Uraba, Zenu (Sinu), Tatabé, the valleys of Nore and of Guaca, the mountains of Abibe and Antioquia, are accused, by the same author, of the most ferocious cannibalism; and perhaps that circumstance alone gives rise to the idea that they were of the same race as the Caribs of the West Indies. In the celebrated Provision Real of the 30th of October, 1503, by which the Spaniards are permitted to make slaves of the anthropophagic Indians of the archipelago of San Bernardo, opposite the mouth of the Rio Sinu, the Isla Fuerte, Isla Bura (Baru), and Carthagena, there is more of

[^431]:    * "Tambien dicen que la mar baxa a Ciguare, y de alli a diez jornadas es el Rio de Guangues: para que estas tierras estan con Veragua como Tortosa con Fuenterabia o Pisa con Venecia." [Also it is said that the sea lowers at Ciguara, and from thence it is a ten days' journey to the river Ganges; for these lands are, with reference to Veragua, like Tortosa with respect to Fuenterabia, or Pisa, with respect to Venice.]These words are taken from the Lettera Rarissima of Columbus, of which the original Spanish was lately found, and published by the learned M. Navarrete, in his Coleccion de Viages, vol. i, p. 299.
    + In carefully collating the testimonies of the historians of the Conquest, some contradictions are observed in the periods assigned to the foundation of the towns of Darien. Pedro de Cieça, who had been on the spot, affirms, that under the government of Alonzo de Ojeda and Nicuessa, the town of Nuestra Señora Santa Maria el Antigua del Darien was founded on the western coast of the Gulf or Culata de Uraba, in 1509; and that later (despues desto passado) Ojeda passed to the eastern coast of the Culata to construct the town of San Sebastian de Uraba. The former, called by abbreviation Ciudad del Antigua, had soon a population

[^432]:    * Don Jorge Juan, in his Secret Notices, addressed to the Marques de la Ensenada, says: "La entrada antigua era por un angosto canal que llaman Buca Chica; de resultas de esta invasion se acordo deja cioga y impassable la Boca Grande, y volver a abrir la antigua fortificandola." [The old entrance was by a narrow channel called the Boca Chica; but after this invasion, it was determined to close up the Boca Grande, and to $\mu$, open the old passage, fortifying it.]-Secr. Not. vol. i, p. 4.

[^433]:    * At the foot of the two forts (San José and San Fernando), constructed for the defence of the Boca Chica, it may be seen how much the land has gained upon the sea. Necks of land are formed on both sides, and also before the Castillo del Angel, which, northward, commands the fort of San Fernando.

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[^434]:    * It appears probable that at the end of 1825, of the total population of men of colour (mulattos and negroes, free and slaves), there were nearly $\mathbf{1 6 0 , 0 0 0}$ in the towns, and 230,000 in the fields. In 1811, the Consulado, in a statement presented to the Cortes of Spain, computed at 141,000 , the number of men of colour in the cowns, and 185,000 in the fields. (Documentos sobre los Negros, p. 121.) This great accumulation of mulattos, free negros, and slaves, in the towns, is a characteristic feature in the island of Cuba.

[^435]:    * See the curious revelations in Juan de Marieta, Hist. de todos los Santos de España, libro vii, p. 174.
    + The rage of hanging themselves by whole families, in huts and caverns, as related by Garcilasso, was no doubt the effect of despair ; yet instead of lamenting the barbarism of the sixteenth century, it was attempted to exculpate the conquistadores, by attributing the disappearance of the natives to their taste for suicide. See Patriota, tom. ii, p. 50. Numerous sophisms of this kind are found in a work published by M. Nuix, on the humanity of the Spaniards in the conquest of America. This work is entitled, " Reflexiones imparciales sobre la humanidad de los Epanoles contra los pretendidos filnsofos y politicos, para illustrar las historias de Raynal y Robertson; escrito en Italiano por el Abate Don

[^436]:    * The clergy of the island of Cuba is neither numerous nor rich, if we except the Bishop of the Havannah and the Archbishop of Cuba, the former of whom has 110,000 piastres, and the latter 40,000 piastres per annum. The canons have 3000 piastres. The number of ecclesiastics does not exceed 1100, according to the official enumeration in my passession.

[^437]:    * On the trapiches or molinos de agua of the sixteenth century, see Oriedo, Hist. nat. des Ind., lib. 4, cap. 8.
    † Lopez de Gomara, Conquista de Mexico (Medina del Campo, 1353), fol. 129.

[^438]:    * The agrarian measure, called calalleria, is eighteen cordels, (each cordel includes twenty-four varas) or 432 square varas ; consequently, as 1 vara $=0.835^{\mathrm{m} \cdot}$, according to Rodriguez, a caballeria is 186,624 square varas, or 130,118 square metres, or thirty-two and two-tenths English acres.

[^439]:    * There are very few plantations in the whole island of Cuba capable of furnishing 40,000 arrobas; among these few are the yngenio of Rio
    - Blanco, or of the Marquess del Arca, and those belonging to Don Rafael Ofarrel, and Dofia Felicia Jaurregui. Sugar-houses are thought to be very considerable that yield 2000 cases annually, or 32,000 arrobas (nearly 368,000 kilogrammes.) In the French colonies, it is generally computed that the third or fourth part only of the land is allotted for the plantation of food, (bananas, ignames, and batates); in the Spanish colonies, a greater surface is lost in pasturage; this is the natural consequence of the old habits of the haciendas de yanado.

[^440]:    * Before the year 1807, when the tax on coffee was reduced, the consumption of Great Britain was not 8000 cwt . (less than i million of

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[^441]:    * "De muchas parras monteses con ubas se ha cogido vino, aunque algo agrio." [From several grape-bearing vines which grow in the mountains, they extract a kind of wine ; but it is very acid.] (Herera, Dec. I, p. 233.) Gabriel de Cabrera found a tradition at Cuba similar to that which the people of Semitic race have of Noah, experiencing for the first time the effect of a fermented liquor. He adds, that the idea of two races of men, one naked, another clothed, is linked to the American tradition. Has Cabrera, preoccupied by the rites of the Hebrews, imperfectly interpreted the words of the natives, or, as seems more probable, has he

[^442]:    *The custom.house of Port-au-Prince, at Hayti, produced in 1825, the sum of $1,655,764$ piastres; that of Buenos Ayres, from 1819 to 1821, average year, $1,655,000$ piastres. See Cenlinela de La Plata (September, 1822), No. 8 ; Argos de Buenos Ayres, No. 85.

[^443]:    * The custom-houses of the United States, which yielded in 1801 to 1808, sixteen millions of dollars, produced in 1815 but $7,282,000$.

[^444]:    * Such comparisons do not satisfy those secret partizans of the slavetrade, who try to make light of the miseries of the black race, and to resist every emotion those miseries awaken. The permanent condition of a caste founded on barbarous laws and institutions, is often confounded with the excesses of a power temporarily exercised on individuals. Thus Mr. Bolingbroke, who lived seven years at Demerara, and who visited the West India Islands, observes that " on board an English ship of war, flogging is more frequent than in the plantations of the English colonies." He adds, "that in general the negroes are but little flogged, but that very reasonable means of correction have been imagined, such as making them take boiling soup strongly peppered, or obliging them to drink, with a very small spoon, a solution of Glauber-salts." Mr. Bolingbroke regards the slave-trade as an universal benefit ; and he is persuaded that if negroes who have enjoyed, during twenty years, all the comforts of slave life at Demerara, were permitted to return to the coast of Africa, they would effect recruiting on a large scale, and bring whole nations to the English possessions. (Voyage to Demerara, 1807). Such is the firm and frank profession of faith of a planter ; yet Mr. Bolingbroke, as several passages of his book prove, is a moderate man, full of benevolent intentions towards the slaves.

[^445]:    * "If the slaves are whipped," said one of the witnesses, before the Parliamentary Committee of 1789, "to make them dance on the deck of a slave-ship-if they are forced to sing in chorus; 'Messe, messe, mackerida,' [how gaily we live among the whites], this only proves the care we take of the health of those men." This delicate attention reminds me of the description of an auto-da-fe in my possession. In that curious document a boast is made of the prodigality with which refreshments are distributed to the condemned, and of the staircase which the inquisitors have had erected in the interior of the pile for the accommodation of the relasados, (the relapsed culprits.)

[^446]:    * General Lafayette, whose name is linked with all that promises to contribute to the liberty of man and the happiness of mankind, conceived, in the year 1785, the project of purchasing a settlement at Cayenne, and to divide it among the blacks by whom it was cultivated, and in whose favour the proprietor renounced for himself and his descendants, all benefit whatever. He had interested in this noble enterprise the priests of the Mission of the Holy Ghost, who themselves possessed lands in French Guiana. A letter from Marshal de Castries, dated 6th June, 1785, proves that the unfortunate Louis XVI., extending his beneficent intentions to the blacks and free men of colour, had ordered similar experiments to be made at the expense of Government. M. de Richeprey, who was appointed by M. de Lafayette to superintend the partition of the lands among the blacks, died from the effects of the climate at Cayenne.

[^447]:    * In 1769, forty-six years before the declaration of the Congress at Vienna, and thirty-eight years before the abolition of the slave-trade, decreed in London and at Washington, the Chamber of Representatives of Massachusetts had declared itself against " the unnatural and unwarrantable custom of enslaving mankind." (See Walsh's Appeal to the United States, 1819, p. 312.) The Spanish writer, Avendañ, was perhaps the first who declaimed forcibly not only against the slave-trade, abhorred even by the Afghans (Elphinstone's Journey to Cabul, p. 245), but against slavery in general, and " all the iniquitous sources of colonial wealth." (Thesaurus Ind., tom. i, tit. 9, cap. 2.)

[^448]:    - Vol. vii, p. 151. See also the eloquent speech of the Duke de Broglie (March 28th, 1822), pp. 40, 43, 96.
    $\dagger$ "Dicen nuestros Indios del Rio Caura cuando se confiesan que ya entienden que es pecado comer carne humana; pero piden que se les permita desacostumbrarse poco a poco; quieren comer la carne humana una vez al mes, despues cada tres meses, hasta que sin sentirlo pierdan la costumbre." Cartas de los Rev. Padres Observantes, No. 7 M.S. ["Our negroes of the River Caura say, when they confess, that they know it is sinful to eat human flesh; they beg to be permitted to break themselves of the custom, little by little: they wish to eat human flesh once a month, and afterwards once every three months, until they feel they have cured themselves of the practice.]

[^449]:    * Reglamento sobre los Negros Cimmarrones de 26 de Dec. de 1796. Before the year 1788, there were great numbers of fugitive negroes (cimmarones) in the mountains of Jaruco, where they were sometimes apalancados, that is, where several of those unfortunate creatures formed small intrenchments for their common defence, by heaping up trunks of trees. The maroon negroes, born in Africa (bozales), are easily taken; for the greater number, in the vain hope of finding their native land, march day and night in the direction of the east. When taken, they are so exhausted by fatigue and hunger, that they are only saved by giving them, during several days, very small quantities of soup. The creole maroon negroes conceal themselves by day in the woods, and steal provisions during the night. Till 1790, the right of taking the fugitive negroes belonging only to the Alcalde mayor provincial, am hereditary office in the family of the Count de Bareto. At present, any of the inhabitants can seize the maroons, and the proprietor of the slave pays four piastres per head, besides the food. If the name of the master is not known, the Consulado employs the maroon negro in the public works. This man-hunting, which, at Hayti and Jamaica, has given so much fatal celebrity to the dogs of Cuba, was carried on in the most cruel manner before the regulation which I have mentioned above.

[^450]:    * Informe sobre negros fugitivos (de 9 de Junio de 1769), por Don Francisco de Arango y Pareño, Oidor honorario y syndico del Consulado.
    + The right of buscar amo. When a slave has found a new master who will purchase him, he may quit the master of whom he has to complain; such is the sense and spirit of a law, beneficent, though often eluded, as are all the laws that protect the slaves. In the hope of enjoying the privilege of buscar amo, the blacks often address to the travellers they meet, a question, which in civilized Europe, where a vote or an opinion is sometimes sold, is more equivocally expressed; Quiere Vm. comprarme? [Will you buy me, Sir ?]
    $\ddagger$ A slave in the Spanish colonies ought, according to law, to be estimated at the lowest price ; this estimate, at the time of my journey, was, according to the locality, from 200 to 350 piastres. In 1825, the price of an adult negro, at the island of Cuba, was 450 piastres. In 1788, the French trade furnished a negro for 280 to 300 piastres. A slave, among the Greeks, cost 300 to 600 drachmes ( 54 to 108 piastres), when the day-labourer was paid one.tenth of a piastre. While the Spanish laws and institutions favour manumission in every way, the master, in the other islands, pays the fiscal, for every freed slave, five to seven hundred piastres !
    $\S$ What a contrast is observable between the humanity of the most ancient Spanish laws concerning slavery, and the traces of barbarism found in every page of the Black Code, and in some of the provincial laws of the English islands! The laws of Barbadoes, made in 1686, and those of Bermuda, in 1730, decreed that the master who killed his negro in chastising him, could not even be sued, while the master who killed his slave wilfully, should pay ten pounds sterling to the royal treasury. A law of Saint Christopher's, of March 11th, 1784, begins with these words:

[^451]:    "Whereas some persons have of late been guilty of cutting off and depriving slaves of their ears, we order that whoever shall extirpate an eye, tear out the tongue, or cut cff the nose of a slave, shall pay five hundred pounds sterling, and be condemned to six months imprisonment." It is unnecessary to add, that these English laws, which were in force thirty or forty years ago, are abolished and superseded by laws more humane. Why can I not say as much of the legislation of the French islands, where six young slaves, suspected of an intention to escape, were condemned, by a sentence pronounced in 1815, to have their hamstrings cut!

    * A royal cedula, of May 31st, 1789, had attempted to regulate the food and clothing ; but that cedula was never executed.

[^452]:    * Namely : 452,000 whites, of which 342,000 are in the two Spanish islands (Cuba and Porto Rico), and 423,000 free men of colour, mulattoes, and blacks.

[^453]:    * Almost double the extent of Europe.
    + Map of Columbia, according to the astronomical observations of Humboldt, by A. H. Brue, 1823.

[^454]:    * According to the measure of MM. Spix and Martins, the Itambe de Villa de Principe is 5590 feet high.
    †The Peak Iewahir, lat. $30^{\circ} 22^{\prime} 19^{\prime \prime}$; long. $77^{\circ} 35^{\prime} 7^{\prime \prime}$ east of Paris. Height 4026 toises, according to MM. Hodgson and Herbert.
    $\ddagger$ This peak, called also peak of Anethou or Malahita, or eastern peak of Maladetta, is the highest summit of the Pyrenees. It rises 1787 toises; and consequently exceeds Mont Perdu by 40 toises.

[^455]:    * In the passage of Quindiu; between the valley of the Magdalens and that of the Rio Cauca, I fonnd the culminant point (la Garita del Parama), to be 1798 toises; it is however, regarded as one of the least elevated. The passages of the Andes of Guanacas, Guamani, and Micuipampa, are respectively 2300,1713 , and 1817 toises above sea-level. Even in $33^{\circ}$ south latitude, the road across the Andes between Mendoza and Valparaiso is 1987 toises high. I do not mention the Col de l'Assuay, where I passed, near la Ladera de Cadlud, on a ridge 2428 toises high, because it is a passage on a tranverse ridge joining two parallel chains.
    $\dagger$ The passes of the Himalaya that lead from Chinese Tartary into Hindostan (Nitee-Ghaut, Bamsaru, \&c.), are from 2400 to 2700 toises high.
    $\ddagger$ The Cols or passes indicate the minimum of the height to which the ridge of the mountains lowers in a particular country. Now, looking at the principal passes of the Alps of Switzeriand (Col Terret, 1191 toises; Mont Cenis, 1060 toises; Great Saint Bernard, 1246 toises; Simplon, 1029 toises; and on the neck of the Pyreenees, Benasque, 1231 toises; Pinède, 1291 toises; Gavarnic, 1197 toises; Cavarère, 1151 toises; it would be difficult to affirm that the Pyrenees are lower than the average height of the Swiss Alps.

[^456]:    *This peak, according to the survey of M. Clemente Roxas, is 1826 toises above the level of the sea, consequently 39 toises higher than the loftiest summit of the Pyrenees (the granitic peak of Nethou), and 83 toises lower than the trachytic peak of Teneriffe. The Sierra Nevada of Grenada forms a system of mountains of mica-slate, passing to gneiss and clay-slate, and containing shelves of euphotide and greenstone.
    $\dagger$ If we may judge from the specimens of rocks collected in the gorge. and passes of the Himalajas, or rolled down by the torrents.

[^457]:    * The breadth of this immense chain is a phenomenon well worthy of attention. The Swiss Alps extend, in the Grisons and in the Tyrol, to a breadth of 36 and 40 leagues, both in the meridians of the lake of Como, the canton of Appenzell, and in the meridian of Bassano and Tegernsee.
    * Klaproth, Asia polyglotta, p. 211. It appears to me less probable that the tribe of the Antis gave its name to the mountains of Peru.

[^458]:    * I agree with Captain Basil Hall, in fixing the port of Valparaiso in $71^{\circ} 31^{\prime}$ west of Greenwich, and I place Cordova $8^{\circ} 40^{\prime}$, and Santa Cruz de la Sierra $7^{\circ} 4^{\prime}$ east of Valparaiso. The longitudes mentioned in the text refer always to the meridian of the Observatory of Paris.

[^459]:    * For much information concerning the Sierra de Cochabamba, I am indebted to the manuscripts of my countryman, the celebrated botanist Taddeus Haenke, which a monk of the congregation of the Escurial, Father Cisneros, kindly communicated to me at Lima. Mr. Haenke, after having followed the expedition of Alexander Malaspina, settled at Cochabamba, in 1798. A part of the immense herbal of this botanist is now at Prague.

[^460]:    * Between the mountain of Tentenade and the Port d'Espot.

[^461]:    * Choco, Barbacoas, and Brazil are the only countries in which the existence of grains of platinum and palladium has hitherto been fully ascertained. The small town of Barbacoas is situated on the left bank of the Rio Telembi (a tributary of Patias or the Rio del Castigo), a little above the confluence of Telembi and the Guagi or Guaxi, nearly in lat. $\mathbf{1}^{\circ} \mathbf{4 8 '}^{\prime}$. The ancient Provincia, or rather the Partido del Raposo, comprehends the insalubrious land extending from the Rio Dagua, or San Buenaventura, to the Rio Iscuande, the southern limit of Choco.
    $\dagger$ M. Caldas assigus to the upper limit of the zone of gold-washings, only the height of 350 toises. Semanario, (tom. i, p. 18); but I found theJavaderns of Quilichao, on the north of Popayan, to be 565 toises high.

[^462]:    * I here subjoin some measures interesting to geologists. Area of the Andes, from Tierra del Fuego to the Paramo de las Rosas (lat. $94^{\circ}$ north), where the mountainous land of Tocuyo and Barquesimeto begins, part of the Cordillera of the shore of Venezuela, 58,900 square leagues, ( 20 to a degree) the four spurs of Cordova, Salta, Cochabamba, and Beni alone,

[^463]:    * I am inclined to believe that the southern part of the basin of the Upper Marañon, between Huary and Huacarachuco, exceeds 350 toises.
    $\dagger$ In the region of the Andes comprehended between $4^{\circ}$ of sonth latitude and $2^{\circ}$ of north, the longitudinal vallies or basins inclosed by parallel chains, are regularly between 1200 and 1500 toises high ; while the transversal vallies are remarkable for their depression, or rather the rapid towering of their bottom. The valley of Patias, for instance, running from N.E. to S.W. is only 350 toises of absolute height, even above the junction of the Rio Guachion with the Quilquasi, according to the barometric measures of M . Caldas ; and yet it is surrounded by the highest summits, the Paramos de Puntaurcu and Mamacondy. Going from the plains of Lombardy, and penetrating into the Alps of the Tyrol, by a line perpendicular to the axis of the chain, we advance more than 20 marine leagues towards the north, yet we find the bottom of the valley of the Adige and of Eysack near Botzen, to be only 182 toises of absolute height, an elevation which exceeds but 117 toises that of Milan. From Botzen however, to the ridge of Brenner (culminant point, 746 toises), is only 11 leagues. The Valais is a longitudinal valley; and in a barometric measurement which I made very recently from Paris to Naples and Berlin, I was surprised to find that from Sion to Brigg, the bottom of the valley rises only to from 225 to 350 toises of absolute height; nearly the level of the plains of Switzerland, which, between the Alps and the Jura, are only from 274 to 300 toises.

[^464]:    * Von Buch, Tableau du Tyrol meridional, p. 8. 1823.
    + If it be true, as some navigators affirm, that the mountains at the N. W: extremity of the republic of Columbia, known by the names of Silla de Veragua, and Castillo del Choco, be visible at 36 leagues distance, the elevation of their summits must be nearly 1400 toises, little lower than the Silla of Caracas.
    $\ddagger$ See the list of twenty-one volcanos of Guatimala, partly extinct, and partly still burning, given by Arago and myself, in the Annuaire du Bureau des Longitudes pour 1824, p. 175. No mountain of Guatimala having been hitherto measured, it is the more important to fix approximately the height of the Volcan de Agua, or the Volcano of Pacaya, and the Volcan de Fuego, called also Volcano of Guatimala. Mr. Juarros expressly says, that this voicano, which by torrents of water and

[^465]:    * On this zone of volcanoes is the parallel of the greatest heights of New Spain. If the survey of Captain Basil Hall afford results alike certain in latitude and in longitude, the volcano of Colima is north of the parallel of Puerto de Navidad, in lat. $19^{\circ} 36^{\prime}$; and, like the volcano of Tuxtla, if not beyond the zone, at least beyond the avarage parallel of the volcanic fire of Mexico, which parallel seems to be between $18^{\circ} 59^{\prime}$, and $10^{\circ} 12^{\prime}$.

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[^466]:    * The Rocky Mountains have been at different periods designated by the names of Chypewyan, Missouri, Columbian, Caous, Stony, Shining, and Sandy Mountains.

[^467]:    * Volcanes de las Virgenes. The highest summit of Old California, the Cerro de la Giganta ( 700 toises), appears to be also an extinguished volcano.

[^468]:    - It is more than double the length of the Pyrenees, from Cape Creux to the point of Figuera.

[^469]:    * The other hot springs of the Cordillera of the shore, are those of S. Juan, Provisor, Brigantin, the gulf of Cariaco, Cumucatar, and Irapa. MM. Rivero and Boussingault, who visited the thermal waters of Mariara in February, 1823, during their journey from Caracas to Santa Fe de Bogota, found their maximum to be $64^{\circ}$ cent. I found it at the same season, only $59 \cdot 2^{\circ}$. Has the great earthquake of the 26th March, 1812, had an influence on the temperature of these springs? The able chemists above mentioned were, like myself, struck with the extreme purity of the hot waters that issue from the primitive rocks of the basin of Aragua. Those of Onoto, which flow at the height of 360 toises above the level of the sen, have no smell of sulphuretted hydrogen; they are without taste, and cannot be precipitated, either by nitrate of silver or any other re-agent. When evaporated, they have an inappreciable residue, which consists of a little silica and a trace of alkali; their temperature is

[^470]:    * This basin contains a small system of inland rivers, which do not communicate with the ocean. The southern chain of the litteral Cordillera of Venezuela is so depressed on the south-west, that the Rio Pao is separated from the tributary streams of the lake of Tacarigua or Valencia. Towards the east, the Rio Tuy, which takes its rise on the western declivity of the knot of mountains of Las Cocuyzas, appears at first to empty itself into the vallies of Aragua; but hills of calcareous tufa, forming a ridge between Consejo and Victoria, force it to take its course south-east.

[^471]:    * The bottom of the first of these four basins bounded by parallel chains, is from 230 to 460 toises above, and that of the two latter from 30 to 40 toises below the present sea-level. Hot springs gush from the bottom of the gulf of the basin of Cariaco, as from the bottom of the basin of Valencia on the continent.

[^472]:    * It is affirmed that the island of Trinidad is traversed in the northern part by a chain of primitive slate, and that Grenada furnishes basalt. It would be important to examine of what rock the island of Tobago is composed; it appeared to me of dazzling whiteness; and on what point, in going from Trinidad northward, the trachytic and trappean system of the Lesser Antilles begins.

[^473]:    * The Rio Parime, after receiving the waters of the Uraricuera, joins the acuta, and forms, near the fort of San Joacquim, the Rio Branco, one of the tributary streams of the Rio Negro.

[^474]:    * To this series of advanced rocks also belong those which pierce the soil between the Rio Aquire and the Rio Barima; the granitic and amphibolic rocks of the Vieja Guayana and of the town of Angostura; the Cerro de Mono on the south -east of Muitaco or Real Corono ; the Cerro of Taramuto near the Alta Gracia, \&c.

[^475]:    * The portages of Sarauru and the lake Amucu:

[^476]:    *When we know that in Tamanac gold is called caricuri ; in Carib, caricura: in Peruvian, cori (curi), we easily recognize in the names of the mountains and rivers (Yguara-curu, Cura-patuba), which we have just marked, the indication of auriferous soil. Such is the analogy of the imported roots in the American tongues, which otherwise differ altogether from each other, that 300 leagues west of the mountain Ygaracuru, on the banks of the Caqueta, Pedro de Ursua heard of the province of Caricuri, rich in gold washings. The Curupatuba falls into the Amazon near the Villa of Monte Alegre, N. E. of the mouth of the Rio Topayos.

[^477]:    * The rocky ridges that form the cataract of Paulo Affonso, in the Rio San Francisco, are supposed to belong to the northern prolongation of the Serra do Espinhaço, as a series of heights in the province of Seara (fetid calcareous rocks, containing a quantity of petrified fish,) belong to the Serra dos Vertentes.

[^478]:    * Not even the White Mountains of the state of New Hampshire, to which Mount Washington belongs. Long before the accurate measurement of Captain Partridge, I had proved (in 1804), by the laws of the decrement of heat, that no summit of the White Mountains could attain the height assigned to them by Mr. Cutler, of 1600 toises.
    $\dagger$ The southern hemisphere, owing to the unequal distribution of seas and continents, has long been marked as eminently aquatic; but the same inequality is found when we consider the globe as divided not according to the equator but by meridians. The great masses of land are stinted between the meridian of $10^{\circ}$ west, and $150^{\circ}$ east of Paris, while the hemisphere eminently aquatic begins westward of the meridian of the coast of Greenland, and ends on the east of the meridian of the eastern coast of New Holland and the Kurile Isles. This unequal distribution of land and water has the greatest influence on the distribution of heat over the surface of the globe, on the inflexions of the isothermal lines, and the climateric phenomena in general. For the inhabitants of the central parts of Europe the aquatic hemisphere may be called western, and the land hemisphere eastern; because in going to the west we reach the former sooner than the latter. It is the division according to the meridians, which is intended in the text. Till the end of the 15th century, the western hemisphere was as much unknown to the nations of the eastern hemisphere, as one half of the lunar globe is to us at present, and will probably always remain.

[^479]:    * Culminant points; Malhacen of Grenada, 1826 toises; Etna, according to Captain William Henry Smith, 1700 toises; Monte Corno of the Appenines, 1489 toises. If Mount Tomoros in Greece and the Serra Gaviarra of Portugal, enter, as is alleged, into the limit of perpetual snow, those summits, according to their position in latitude, should attain from FOL. III.

    2 A

[^480]:    1400 to 1600 toises. Yet on the loftiest mountains of Greece, Tomoros, Olympus in Thessaly, Polyanos in Dolope, and Mount Parnassus, M. Pouqueville saw, in the month of August, snow lying only in patches, and in cavities sheltered from the rays of the sun.

    * The Lömnitzer Spitz of the Carpathians, is, according to M. Wahlenberg, 1245 toises ; Sneebattan, in the chain of Dovrefjeld in Norway (the highest summit of the old continent, north of the parallel of $55^{\circ}$ ), is 1270 toises above the level of the sea.

[^481]:    * Between Tobago and Grenada; Saint Martin and the Virgin Isles; Porto Rico and Saint Domingo ; and between the Little Bank of Bahama and Cape Cafiaveral of Florida.
    + I do not pretend that this hypothesis of the rupture and the ancient continuity of lands can be extended to the eastern foot of the basin of the West Indies, that is, to the series of the volcanic islands in a line from Trinidad to Porto Rico.

[^482]:    * Hatan Pampa signifies in that language, 'a great plain.' We find the word Pampa also in Riobamba and Guallabamba; the Spaniards, in order to soften the geographical names, changing the $p$ into $b$.

[^483]:    * Leopold von Buch. Tableau géologique du Tyrol, p. 17. M. Boussingault states that these singular Morros de San Juan, which furnish a limestone with crystalline grains, and thermal springs, are hollow, and contain immense grottos filled with stalactites, which appear to have been anciently inhabited by the natives.

[^484]:    * Braunes eisenschuissiges Sandstein-Conglomerat (Iron-sand of the English geologists, between the Jura limestone and green sandstone.) MM. Spix and Martius found on rocks of quadersandstein, between the Apoporis and the Japura, the same sculptures which we have pointed out from the Essequibo to the plains of Cassiquiare, and which seem to prove the migrations of a people more advanced in civilization than the Indians who now inhabit those countries.
    † Is this wall a succession of rocks of dolomite or a dyke of quadersandstein, like the Devil's Wall (Teufelsmauer), at the foot of the Hartz ? Calcareous shelves (coral banks), either ledges of sandstone (effects of the revulsion of the waves) or volcanic eruptions, are commonly found on the borders of great plains, that is, on the shores of ancient inland seas. The Llanos of Venezuela furnish examples of such eruptions near Parapara,

[^485]:    * Positive geography being nothing but a question of the series or succession (either simple or periodical) of certain terms represented by the formations, it may be necessary, in order to understand the discussions contained in the third section of this memoir, to enumerate succinctly the table of formations considered in the most general point of view.
    I. Strata commonly called Primitive; granite, gneiss, and mica-slate (or gneiss oscillating between granite and mica-slate); very little primitive clay-slate; weisstein with serpentine; granite with disseminated amphibole ; amphibolic slate; veins and small layers of greenstone.
    II. Transition strata, composed of fragmentary rocks, (grauwacke,) calcareous slate, and greenstone . earliest remains of organized existence : bamboos, madrepores, producta, trilobites, orthoceratites, evamphalites). Complex and parallel formations; (a) Alternate beds of grey and stratified limestone, anthracitic mica-slate, anhydrous gypsum, and grauwacke; (b) Clay-slate, black limestone, grauwacke with greenstone, syenite, transitiongranite, and porphyries with a base of compact felspar; (c) Euphotides, sometimes pure and covered with jasper, sometimes mixed with amphibole, hyperstein, and grey limestone; (d) Pyroxenic porphyries with amygdaloides and zirconian syenites.
    III. Secondary strata, presenting a much smaller number of monocotyledonous plants; (a) Co-ordinate and almost contemporary formations with red sandstone (rothe todtes liegende), quartz-porphyry, and fern-coal. These strata are less connected by alternation than by opposition. The

[^486]:    * Primitive limestone, everywhere so common in mica-slate and gneiss, is found in the granite of the Pyrenees, at Port d'Ô, and in the mountains of Labourd.

[^487]:    * To prove the extent of the continuity of this granitic stratum, it will suffice to observe that M. Lechenault de la Tour collected in the bars of the river Mana, in French Guiana, the same gneiss-granites (with a little amphibole) which I observed three hundred leagues more to the west, near the confluence of the Orinoco and the Guaviare.
    + I did not observe this mixture of amphibole in the granite of the littoral chain of Venezuela, except at the summit of the Silla of Caracas.
    $\ddagger$ Schrift-granit. It is a simple modification of the composition and texture of graniie, and not a subordinate layer. It must not be confounded with the real pegmatite, generally destitute of mica, or with the 'geographic stones' (piedras mapajas) of the Orinoco, which contain streaks of dark green mica irregularly disposed.
    § The maznetic sands of the rivers that furrow the granitic chain of the Encaramada seem to denote the proximity of amphibolic or chloritic slate (hornblende or chloritschiefer), either in layers in the granite, or superposed on that rock.

[^488]:    *These legends of diamonds are very ancient on the coast of Paria. Petrus Martyr relates, that at the beginning of the sixteenth century, a Spaniard named Andres Morales bought of a young Indian of the coast of Paria " admantem mire pretiosum, duos infantis digiti articulos longum, magni antem pollicis articulum æquantem crassitudine, acutum utrobique et costis octo pulchre formatis constantem." [A diamond of marrellous value, as long as two joints of an infant's finger, and as thick as one of the joints of its thumb, sharp on both sides, and of a beautiful octagonal shape.] This pretended "adamas juvenis pariensis" resisted the action of lime. Petrus Martyr distinguishes it from topaz by adding, "offenderunt et topazios in littore," [they pay no heed to topazes on the coast] that is of Paria, Saint Marta, and Veragua. See Oceanica, Dec. iii, lib. iv. p. 53.

    + I have been assured that the islands Orchila and Los Frailes are also composed of gneiss; Curacao and Bonaire are calcareous. Is the island of Oruba (in which nuggets of native gold of considerathle size have been found) primitive ?

[^489]:    * The Silla is a mountain of gneiss like Adam's Peak, in the island of Ceylon, and of nearly the same height.

[^490]:    * In Galicia, in Spain, I saw the thonschiefer containing chiastholite, alternate with grauwacke; but the chiastholite unquestionably belongs also to rocks which all geologists have hitberto called primitive rocks, to mica-schists intercalated like layers in granite, and to an independent stratum of mica-slate.

[^491]:    * Broken and intact crystals of feldspar are found in the todte liegende coal-sandstone of Thuringia. I observed in Mexico a very singular agglomerated felspar formation, superposed upon (perhaps inclosed in) red sandstone, near Guanaxuato.
    + In Germany, sandstones which belong unquestionably to red sandstone, contain also (near Weiderstadt, in Thuringia) nodules, and rounded fragments. I shall not cite the pudding-stone subordinate to the red sindstone of the Pyrenees, because the age of that sandstone destitute of coal may bo disputed. Layers of very large rounded nodules of quartz are inclosed in the cral sandstone of Thuringia, and in Upper Silesia.

[^492]:    *The people of the country attribute those woods to the Alcornoco, Bowdichia virgilioïdes (See Nova Gen. et Spec. Plant. vol. iii, p. 377), and to the Chaparro bovo, Rhopala complicata. It is believed, in Venezuela as in Egypt, that petrified wood is formed in our times. I found this dicotyledonous petrified wood only at the surface of the soil, and not inclosed in the sandstone of the Llanos. M. Caillaud made the same observation on going to the Oasis of Siwa. The trunks of trees, ninety feet long, inclosed in the red sandstone of Kifhauser (in Saxony), are, according to the recent researches of Von Buch, divided into joints, and are certainly monocotyledonous.

[^493]:    * The forms of these rocks in walls and pyramids, or divided in rhomboid blocks, seems no doubt to indicate quadersandstein; but the sandstone of the eastern declivity of the Rocky Mountains, in which the learned traveller Mr. James, found salt-springs (licks), strata of gypsum, and no coal, appear rather to belong to variegated sandstone (bunter sandstein).
    + This coal immediately covers, as in Belgium, the grauwacke, or transition-sandstone.
    $\ddagger$ In the plains of the Upper Missouri the limestone is immediately covered by a secondary limestone with turritulites, believed to be Jurassic, while a limestone with gryphes, rich in lead-ore, and which I should have believed to be still more ancient than oolitic limestone, and analogous to lias, is described by Mr. James as lying above the most recent formation of sandstone. Has this superposition been well ascertained?
    § Formation of molassus.
    || M. von Buch very reasonably inquires whether this statuary limestone, which resembles Parian marble, and limestone become granular by contact with the systematic granite of Predazzo, is a modification of

[^494]:    * I found them also in the Peruvian Andes, near Montau, at the height of 1600 toises.

[^495]:    * Tertiary sandstone with lignites, or molassus of Argovia.

[^496]:    * The ejected masses in 1822, were so considerable, that the inhabitants of some villages round Vesuvius, collected them for domestic purposes.
    + Gay-Lussac, on the action of volcanos, in the Annales de Chimie, vol. axii, p. 418.

[^497]:    * An-nicht Auflageruny, according to the precise language of the geologists of my country.

[^498]:    * Table of Organized Fossil Bodies, 1824.
    $\dagger$ The fragments of these rocks appear only in tufas or conglomerates, which belong essentially to basaltic formations, or surround the most recent volcanos. Every volcanic formation is enveloped in breccia, which is the effect of the eruption itself.

[^499]:    * We find examples of the latter in Norway (Vardeknllen, near Skeen). in the mountains of the Thuringerwald; in South Tyrol; at Hefeld in the Hartz, at Bolanos in Mexico, \&c.
    + Black porphyries of M. von Buch.
    $\ddagger$ There are phonolites of basaltic strata (the most anciently known) and phonclites of trachytic strata (Andes of Mexico). The former are generally above the basalts ; and the extraordinary development of felspar in that union, and the want of pyroxene, have always appeared to me very remarkable phenomena.

[^500]:    * I believe the first hypotheses respecting the relation between the burning of volcanoes, and the proximity of the sea, are contained in Etna Dialogus, a very eloquent though little-known work by Cardinal Bembo.
    + I stated in another place the influence of that great catastrophe on the counter-revolution which the royalist party succeeded in bringing about at that time in Venezuela. It is impossible to conceive anything more curious than the negociation opened on the 5 th of April, by the republican government, established at Valencia in the vallies of Aragua, with Archbishop Prat (Don Narciso Coll y Prat), to engage him to publish a pastoral letter calculated to tranquilize the people respecting the wrath of the deity. The Archbishop was permitted to say that this wrath was merited on account of the disorder of morals; but he was enjoined to declare positively, that politics and systematic opinions on the new social order had nothing in common with it. Archbishop Prat lost his liberty after this singular correspondence.

[^501]:    *This error is twofold: it is probable that Brazilian gold, paying the quint, has not, during the last forty years, risen to 5500 kilogrammes. I heretofore shared this error in common with writers on political cconomy, in admitting that the quint in 1810, was still (instead of 26 arrobas or 379 kilogrammes), 51,200 Portuguese ounces, or 1433 kilogrammes; which sapposed a product of 7165 kilogrammes. The very correct information afforded by two Portuguese manuscripts on the gold-washings of Minas Geraes, Minas Novas, and Goyaz, in the Bullion Report for the House of Commons, 1810, acc. p. 29, goes as far only as 1794, when the quinto do ouro of Brazil was 53 arrobas, which indicates a produce of more than 3900 kilogrammes paying the quint. In Mr. Tooke's important work, "On High and Low Prices," part II. p. 2,), this produce is still estimated (mean year 1810-1821), at $1,736,000$ piastres; while, according to official documents in my possession, the average of the quint of those ten years amounted only to 15 arrobas, or a product quint of of 1095 kilogrammes, or 755,000 piastres. Mr. John Allen reminded the Committee of the Bullion Report, in his Critical Notes on the table of M. Brongniart, that the decrease of the produce of the gold-washings of Brazil had been extremely rapid since 1794 ; and the notions given by M. Auguste de Saint Hilaire indicate the same desertion of the gold-mines of Brazil. Those who were miners have become cultivators. The value of an arroba of gold is 15,000 Brazilian cruzados (each cruzado being 50 sous). According to M. Franzini, the Portuguese onça is equal to 028 of a kilogramme, and 8 onças make 1 mark; 2 marks make 1 arratel, and 32 arratels 1 arroba.

