Report on the geoarchaeological investigations in the area around the Pievina excavation (Cinigiano, GR, Italy) 2009

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The geoarchaeological consultancy has aimed at the identification of the major geo-resources of the area around Pievina and at the delimitation of the site catchment area by natural boundaries.

Creation of a Land Units map of the land surrounding the site was proposed, in scale 1:25,000, covering a surface of about 4600 hectares, i.e. ca. 6 x 7.5 km. To that aim, a stereoscopic aerial photograph interpretation was executed during the month of June 2009, which has resulted in a first hypothesis concerning the agricultural potential of the area, a proposal for the boundaries of the site catchment and a working scheme for the field work.

Field work was executed in the week between the 6th and 10th of July 2009. In that period the limits and the content of the Land Units map were checked. Other topics affronted have been: the origin of the stone types found at the excavation (which all but one were identified) and the reason for the strong water influence on the site.

1) Geological framework

What follows is a highly schematized version of the geological evolution of Southern Tuscany. From the Upper Miocene on, a tectonic phase with crust fragmentation occurred, characterized by a stretching structural regime and vertical movements along faults, which determinated a total change of the former paleogeography. The subsided blocks became lake or sea basins and the raised blocks became ridges separating the basins. Sedimentation continued only in the subsided areas. Following several other tectonic events, in the Upper Pliocene and Lower Pleistocene a general uplift occurred, forcing the coast line more or less towards its present position. Volcanism occurred during the Lower and Middle Pleistocene, contemporaneous to the metal ore concentration along the faults.

These tectonic events determined the present lithological and morphological variability of the region: the subsided blocks form the today’s hilly landscape of the Upper Miocene and Pliocene formations, whereas the raised blocks compose the rather steep rocks of the Secondary and Lower Tertiary periods. The alternation between former subsided and uplifted blocks characterizes the greater part of the Tuscan landscape, which therefore can be said to have a “modular” nature.

2 For the geological framework we refer mainly to Lazzarotto 1993, and references cited therein, and to Jacobucci et al. 1967, Motta 1969.
3 The geological chronologies mentioned on these pages are: the later Tertiary period divided in: Miocene from 23 to 5.3 millions of years ago and Pliocene from 5.3 a 1.8 millions of years ago, and the Quaternary period divided in: Pleistocene from 1.8 to 11,000 years ago and Holocene from 11,000 years ago to present.
This typical Tuscan morphology characterizes also the investigated area: the western part is made up of rolling hills in younger geological formations, whereas the eastern part has steep reliefs in older formations belonging to the “Flysch” facies of the so called “Serie Toscana”. The transition between the two landscape types is rather sharp, along a N-S line, and can be observed halfway along the road Cinigiano - Monticello.

Figure 1 gives the schematized distribution of the older and younger geological formations of a wider area, figure 2 is a partial copy of the geological map in scale 1:100,000.

As said, the older formations crop out in the eastern part of the investigated area. They have inclined and folded layers and are locally strongly metamorphized.

Predominant are the following geological formations, all belonging to the “Serie Toscana”, with reference to the geological maps in scale 1.100.000:

- “argilloscisti varicolori” (“sv” on sheet 129; brown on the geological map), with intercalations of red jasper (“sv2”); outcropping in the SE corner of the mapped area and near Stribugliano (outside the mapped area); see photo figure 3.
- quartz-feldspatic sandstones and sand-schists (“macigno”), grey to yellow (“mg” on sheet 128); outcropping to the west of the mapped area;

4 Formations linked to the Apennine orogenesis, sedimented by marine mass movements (“turbidites”).
5 Also available were the new CARG project geological maps in scale 1:25,000 of the Regione Toscana were available, but for the purpose of the present investigation they do not offer more information than the 1:100.000 maps.
- predominantly quartz-calcareous sandstones of the “pietraforte” type, locally with lenses of very small pebbles (pt on sheet 129; olive green on the map); outcropping between Monticello e Arcidosso (outside the mapped area);

- widely distributed in the eastern part of mapped area is the “argillo-scisti” formation (“galestri e palombini”), alternating thin bedded fine grained layers and coarse banks of limestones and marls (“asc” on sheet 128, “ac” on sheet 129; grey on the map); see photo figure 4.

Figure 2: partial copy of the geological map in scale 1:100.000; black outline, area of the Land Units map; blue dot, archaeological site.

Figure 3: red jasper within the “argilloscisti varicolori”, Stribugliano.
Mineral ores are generally related to the older geological formations, but no further inquiries have presently been made on the subject (see fig. 1), since the mining of the two nearby locations mentioned by the Regione Toscana may be of rather recent date (XVI or XII century; see http://159.213.57.71/Miniere/htm/149.htm).

In the eastern part of the mapped area the younger formations predominate, dated from the Upper Miocene on. We will start description from the area of the archaeological site.

According to the geological map at scale 1:100,000, sheet 128, the excavation site is located on the M3 formation, belonging to the Upper Miocene epoch. They are described as well-stratified sands and sandstones, generally not very compact. In the area of Cinigiano the arenaceous beds are reported to be widely extended and regular (see photo figure 6). We noticed in the field that the texture was generally of a very fine sand. This formation covers the preceding marly-clayey formation Mm3, described as marine-lacustrine marls and clays (see photo figure 7). These are mapped just to the west of the site.

These Upper Miocene layers are locally overlain by the Pliocene Pcg formation, described as polygenic conglomerates with various limestone types derived from the older Flysch formations (see photo figure 8).

The stratigraphical relationships of the three formations mentioned are well illustrated by one of the sections reported on the geological map, sheet 128, crossing Cinigiano and Porrona from S to N (see figure 5).
Figure 5: geological section of the area around the site of Pievina, illustrating the superposition, starting from the base, of the formations M₃₀, M₃₁, and Pcg.

Figure 6: road cut or quarry in the sandy M₃ formation, ca. 1000 m E of the Pievina site, along the road Cinigiano - Monticello; mainly very friable fine sand, with some sandstone layers (not visible here).

Figure 7: road cut in the marly-clayey M₃'₃ formation, ca. 2 km S of Cinigiano.
The described distribution pattern is typical for a large part of the central-eastern part of the mapped area. Generally these formations are only slightly tilted.

In the field we gained the impression that the conglomeratic Pcg formation may be more extended than what indicated on the geological maps. We noticed, moreover, that the pebbles within the Pcg conglomerates get gradually coarser from W to SE, from an average of 2 - 3 cm to 10 - 15 cm, together with a general increase in extension and thickness of the formation.

![Figure 8: road cut in the conglomerate Pcg, ca. 1250 m NE of the archaeological site. This formation may be overlying the sandy layers of the Ps or M₃ formation, visible at the base of the outcrop.](image)

The northern and eastern parts of the mapped area are characterized by Pliocene formations (on fig. 2 indicated with yellow colours). These are sands (Ps), marls and clays (Pm) and conglomerates (Pcg; the same that cover the Upper Miocene formations). According to the notes to the geological sheet 128, there is no systematic stratigraphical relationship between the three Pliocene formations.

The conglomerates Pcg have been described above (see photo figure 9). The sandy Ps formation has a limited extension; generally it is poorly cemented. The clayey Pm formation has a large extension in the investigated area; locally it is more or less sandy.
The quartz-latitic volcanites of the Monte Amiata complex crop out to the east of the investigated area, mainly as ignimbrites and reoignimbrites, dating to the Early and Middle Pleistocene. On sheet 129 they are indicated as i’ and i’’, and in the notes described as tuffish-conglomeratic sediments with angular inclusions.

Fluvial terraces (“q” on sheet 128) are widely present to the north of the investigated area. However, the interpretation of the aerial photographs has revealed their presence also within the area, as small strips along some the major rivers (see below, land units map).

Valley floors are rare within the mapped area. The areas indicated as “a” on the geological sheet 128 can be considered mainly as fluvial terraces.

2) Land Units Map

This thematic map pictures the spatial distribution of the Land Units, intended as portions of the territory with homogeneous characteristics as far as soil, substrate, geomorphology and hydrology are concerned.

This kind of map is different from the classical soil map, since land is a wider concept than soil: “Land is a delineable area of the earth's terrestrial surface, encompassing all attributes of the biosphere immediately above or below this surface, including those of the near-surface climate, the soil and terrain forms, the surface hydrology, the near-surface sedimentary layers and associated groundwater reserve, the plant and animal populations, the human settlement pattern and physical results of past and present human activity” (in FAO 1995).

For the methodology of compiling the map see Arnoldus-Huyzendveld & Pozzuto 2008.

The Land Units Map offers a useful way to read, communicate and interpret the physical landscape characteristics of a territory. Moreover, it allows the application of land evaluation, aimed at establishing the agricultural production potential.
The Land Evaluation procedure was developed in the 70s and is defined as “the process of assessment of land performance when used for specified purposes, involving the execution and interpretation of surveys and studies of landforms, soils, vegetation, climate and other aspects of land in order to identify and make a comparison of promising kinds of land use in terms applicable to the objectives of the evaluation” (FAO 1976).

Recently, land evaluation has been applied also in archaeological contexts (Van Joolen 2003, see also Arnoldus-Huyzendveld & Pozzuto 2008), and its applications have been widely discussed in a Workshop of the Conference held in the Netherlands in 2000, with the title “Potential Land Evaluation in Archaeology” (Attema et al. 2002). In this occasion the procedure has been defined as “establishing the potential suitability of ancient landscapes for ancient land uses”.

The Land Units Map of the area around Pieveina covers a surface of about 4600 hectares. Figure 10 gives the location of the registered field observation points in and outside the mapped area.

![Figure 10: in yellow the field observation points registered for the Land Units Map; blue dot, archaeological site; black: map outline.](image)

The map is given in figure 11. The legend has 11 Land Units. For each legend unit are defined: the physiography or lithology, soil depth, soil stoniness, morphology of the landscape, dominant land use, dominant soil type (FAO 1998).
Figure 11: Land Units Map of the area around Pievina, in black the archaeological site, in dark brown the urban areas. Legend: see below.

Legend Land Units Map of the area around Pievina, scale 1:25.000\(^6\)

<table>
<thead>
<tr>
<th>ID</th>
<th>Group</th>
<th>Land Unit</th>
<th>Description</th>
<th>Class (crops)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mc</td>
<td>moderately steep reliefs, locally rocky, with shallow, stony, non calcareous soils, fine textured; dominant use woods; dominant soils <em>Eutric Regosols</em></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mo</td>
<td>undulated reliefs, with moderately deep, moderately stony, non calcareous soils, fine textured; dominant use woods, olives; dominant soils <em>Eutric Cambisols</em></td>
<td>S3</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mv</td>
<td>very deeply incised valleys, rocky, with very shallow, stony, non calcareous soils; dominant use woods; dominant soils <em>Eutric Leptosols</em></td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>N</td>
<td>very steep reliefs, locally rocky, with very shallow, moderately stony, slightly calcareous soils; dominant use woods; dominant soils <em>Eutric Leptosols</em></td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

\(^6\) For the various classes applied, see Arnoldus-Huyzendveld & Pozzuto 2008. They follow mainly the classes proposed in USDA 1993.
<table>
<thead>
<tr>
<th>ID</th>
<th>Group</th>
<th>Land Unit</th>
<th>Description</th>
<th>Class (crops)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Marly-conglomeratic reliefs</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>Kc</td>
<td>hilly landscape, partly undulated, in clay, with moderately deep, calcareous non-stony soils, fine textured (clay and loamy clay), with vertic properties; dominant use crops, olives, vine yards; dominant soils <em>Calcari-Vertic Cambisols</em></td>
<td>S1</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Ks</td>
<td>hilly landscape, partly undulated, in fine sands, locally with pebbles in the higher parts of the reliefs, with moderately deep, calcareous soils, medium textured (silt loam); dominant use crops, olives, vine yards; dominant soils <em>Calcari Cambisols</em></td>
<td>S2</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Kv</td>
<td>deeply incised valley, with shallow, slightly stony, calcareous soils, medium textured (silt loam); dominant use woods; dominant soils <em>Calcaric Regosols</em></td>
<td>N</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Clayey-sandy-conglomeratic reliefs</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Pa</td>
<td>undulating landscape, partly hilly, in clays, with deep, non-stony, calcareous soils, fine textured (clay loam); dominant use crop, olives, vine yards; dominant soils <em>Calcari Cambisols</em></td>
<td>S1</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>Pg</td>
<td>undulating landscape in conglomerates, often with a moderately steep borders, with moderately deep soils, locally reddish in the higher parts of the reliefs, calcareous, moderately stony (pebbles); dominant use woods, shrubs, olives; dominant soils <em>Eutric Cambisols</em></td>
<td>S3</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>T</td>
<td>fluvial terraces and slightly elevated valley floors, almost flat, with moderately deep, moderately stony, calcareous and non-calcareous soils, fine textured (clay loam); dominant use crops; dominant soils <em>Hapli-Cutanic Luvisols</em></td>
<td>S2</td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>A</td>
<td>flat alluvial deposits of the Ribusieri and Melacce rivers, with moderately deep soils, calcareous and non calcareous, fine textured (clay loam); dominant use crops; dominant soils <em>Haplic Fluvisols</em></td>
<td>S3</td>
</tr>
</tbody>
</table>

The photographs of figures 12 - 23 offer an overview of the landscape and soils of the various map units.

Figure 12: from front to back: landscape units *Mo, Mc, Nr.*
Figure 13: formation outcrop and soil profile in unit Mc.

Figure 14: soil profile in colluvium of unit Mo.

Figure 15: foreground and centre, landscape unit Kc.
Figure 16: landscape unit $K_e$ covered by $P_g$.

Figure 17: section of weathered unit $K_s$.

Figure 18: soil surface in unit $K_s$. 
Figure 19: background, landscape unit Pa.

Figure 20: soil surface in unit Pa, with cracks.

Figure 21: soil profile in unit Pg, with reddish colours.
The Land Suitability for crops and tree crops was established for each Land Unit. In terms of a low-technology agriculture, we considered clayey soils more suitable than fine sandy soils, since they have a higher natural fertility and water availability, although they are harder to plough. The map is given in figure 24.

Rough statistics for the various suitability classes are:

<table>
<thead>
<tr>
<th>class</th>
<th>surface in ha</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1650</td>
<td>36</td>
</tr>
<tr>
<td>S2</td>
<td>900</td>
<td>20</td>
</tr>
<tr>
<td>S3</td>
<td>700</td>
<td>15</td>
</tr>
<tr>
<td>N</td>
<td>1350</td>
<td>29</td>
</tr>
</tbody>
</table>
This evaluation implies that the territory of Pievina has a potential area for crop and tree crop production (classes S1, S2) of about 2550 hectares. If the map will be extended to the catchment area proposed (see next section), this area will increase notably.

3) The position of the site in the landscape

The surrounding of the archaeological site is crossed by 3 major rivers with a torrential hydrological regime, from N to S: the Ribusieri, Trisolla and Melace. They all have their origin on the western slopes of the Monte Amiata volcanic edifice, and drain directly towards the Ombrone river, or do so indirectly (T. Ribusieri, through the Orcia river). The aerial photo interpretation revealed some interesting aspects of the river valleys (which was confirmed during field work), i.e. they show an only slightly incised initial tract, followed by a middle tract with a steep and deep valley, and a finally a large valley with flat floor and terraces and rather steep bordering slopes. In figure 25 the three valley types are mapped. Only the T. Trisolla lacks a deeply incised tract. Although this can be considered a normal geomorphological pattern for a valley, in this case the situation is undoubtedly accen-
tuated by the succession, from east to west, of older (steeper, harder) to younger (less steep, softer) geological formations.

This pattern must have had a strong influence on the practical meaning of the valleys for the population: obstacle (crosswise) or preferential pathway (lengthwise).

Figure 25: natural drainage system of the area around the Pievina site; black outline: the mapped area (small) and the area covered by the aerial photographs. In this figure, the evaluation of the soil characteristics is generally based upon the lithological map of the Regione Toscana, and not upon the Land Units Map.

Next some images of the various morphologies along the valleys: photo figure 26, only slightly incised tract of the T. Trisolla; photo figure 27, middle tract of the T. Ribusieri, deeply incised, here ca. 50 m; photo figure 28, lower tract of the T. Trisolla, with valley floor.
Figure 26: slightly incised valley tract of the T. Trisolla (river streaming towards viewer).

Figure 27: steeply incised valley tract of the T. Ribusieri, depth ca. 50 m (river streaming from left to right).

Figure 28: tract with flat valley floor of the T. Trisolla (river in the background near the trees).
Considering these aspects in terms of practical meaning for human mobility, one can say that the slightly incised valleys would be easy to cross, the steep and deep valleys almost impossible to cross and to follow lengthwise, and the valleys with floors rather easy to cross and to follow lengthwise.

From these considerations it follows that the Ribusieri valley, with it’s deep incision and almost N-S direction, may be a good candidate for being the practical boundary of the site catchment area to the east. And moreover, that the Melacce river could be the southern boundary (or part of the eastern boundary) of the catchment, but only in the SE part; the central and SW part of the valley is good for connection, since there is a valley floor, which begins close to the site. This valley forms a direct link to the Ombrone valley floor to the N of Istia, and therefore could be a preferential pathway.

The Trisolla valley is not so much a barrier to the N, since it is not very deep incised; the area of the site is therefore quite open to the N; the flat valley floor forms a good connection to the NW, to the Ombrone valley. The Ombrone and Orcia valleys, with their braided river pattern, can be considered as not easy to cross.

The area around the site is not open to the W, where it is "blocked" by the quite inaccessible areas near Campagnatico (Poggio Sassone, Monte Cucco).

Therefore, my proposal for the natural limits of the site catchment of the Pievina site is, going around clockwise: T. Ribusieri valley, T. Melacce valley, the higher reliefs to the west, the Ombrone and Orcia valleys (see figure 29). To the SE the extension is cut of, quite arbitrary, in the direction were the conglomerates get ever more coarser (see the section on the geological framework), and thus hamper ever more agricultural land use, in particular for crops.

Figure 29: proposal for the extension of the site catchment based upon natural limits. In this figure, the evaluation of the soil characteristics is generally based upon the lithological map of the Regione Toscana, and not upon the Land Units Map.
The surface of this proposed site catchment is ca. 7800 hectares. It is definitely asymmetrical with respect to the location of Pievina.

It is important to note that the only "natural" route from Pievina to the east is the still existing "highroad" Cinigiano-Monticello. Could this imply that the site was a "control point" between the Monte Amiata and the coast? If this is true, it occupies a more "central" position than at first sight.

4) Hydrological aspects of the excavation area

As was said in the section on the geological framework, the area around the site is characterized by the superposition, from bottom to top, of the formations M₃ₘ (sand and sandstones), M₃ₛ (marls and clays) and Pcg (conglomerates).

According to the notes to the geological sheet 128 (Motta 1969), in these Upper Miocene and Pliocene formations well permeable levels are represented by the sandy and, even more, the conglomeratic horizons, which give rise to many small springs, but of a low quality for drinking water.

During the excavation, it was observed by the archaeologists that the site had a permanent rather high groundwater level. It was also observed that the excavation area could be divided in two as far as groundwater is concerned: a northern part without (present) water stagnation problems, and a southern part which not only showed a high groundwater level, but also several traces of antique drainage systems.

Other features linked to water stagnation are the presence, both to the west of the site, of a so-called "fontone" (pond) and of an area were a water puddle on the field was evident during the summer of 2009. The exact hydrogeological dynamics of the fontones are not known (until now I have found no references), but it seems that they are concentrated on less permeable terrain belts that collect the groundwater input from aquifers located higher up (see Arnoldus-Huyzendveld 2008).

A last element is the reporting, by a local inhabitant, of a spring just to the SE of the excavation area. It is to mark that this spring was not found during fieldwork, although the indicated spot is characterized by an abundant vegetation.

Putting these data together, the hypothesis was forwarded that the water abundance of the area could be due to a groundwater outflow from permeable layers, forced by underlying impermeable layers. For that purpose, the texture of the surface layers around the excavation was determined in ca. 70 points, and mapped using a GPS device with a precision of 5 meters.

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7 The “fontone” is a typical Tuscan phenomenon. In the area around Miranduolo - SI, 8 fontones were found, wide depressions that collect the rain- and groundwater. They are evidently the work of man, as demonstrated by the regular and round outline, and moreover not necessarily modern, as shown by the nearness of large oak trees and abandoned structures. These ponds maintain their water level also during the summer. For that reason it was thought that in the choice of location for the ponds, spots may have been favoured were groundwater concentrated already naturally upon the surface. This hypothesis was reinforced by the distribution of the fontones around Miranduolo: without exception they are located upon the transition between the hills and the river terraces or upon the lower slopes of the clayey hills. Higher up, there are steep slopes of “calcarea cavernoso”; a permeable formation limestone and an aquifer.
(see figure 30). The presence of shallow depressions and slightly higher areas was also annotated, in order to reconstruct the courses of natural surface drainage.

It was possible to distinguish between a yellowish fine sandy (loamy) surface layer (see photo figure 18), locally with 3 to 15% pebbles of centimetre size, and a grey clayey epipedon with evident surface cracks (a situation similar to photo figure 20). In several cases there was a transitional loamy texture.

These data were overlain in ArcGIS upon the contour lines with an equidistance of 10 meters\(^8\), and upon the TIN created by Matteo Sordini.

\[\text{Figure 30: map of the soil surface texture of the area around the excavation, indicating sand (fine loamy sand locally with pebbles) and clay (loamy clay). The natural surface drains are indicated with light blue lines (full: certain, dashed presumed). Indicated are also the fontone and the spot with water concentration upon the surface; moreover, the presumed spring.}\]

Although this a rather rough method, which has not involved local drillings or stratigraphical observation (actually there were no outcrops available), some results can be claimed. The map shows that, from SE to NW, the sandy surface layers tend to be replaced by clayey layers. Considering the general stratigraphical relationship of the sediments (sand layers and conglomerates overlying clays) and the local topography, this distribution seems effectively to support the hypothesis that a small aquifer within the coarser layers is forced to the surface by the finer layers, thus causing all encountered phenomena related to water excess.

\(^8\) In scale 1:10.000, thus actually coarser than the detail of the map presented here, which can be considered roughly in a 1:1.000 / 1:2.000 scale.
The transition from fine sandy to clayey substrate is visible not only on the geological map (figure 2), but also in the field. The photo of figure 31 gives an overview from east to west, where on the foreground there are visible sandy hills (unit $K_s$) and in the right hand background light coloured clayey hills (unit $K_c$); the arrow indicates the excavation, hidden behind a ridge in the landscape.

From the first photo interpretation on, the limit between sand and clays was designed in this area more to the E than on the geological map, a position that turned out to agree more with the real situation.

The only other fontone in the investigated area (well distinguishable from the many modern water collection basins) was encountered in the locality Bel Poggio, ca. 2 km NE from Porrorna (see photo figure 32).
Some springs are indicated on the geological map, in the south-eastern corner of the study area (see figures 1, 2). One of them was identified in the field, and is presently captured for drinking water. A small spring with drinking basin was found ca. 1500 m NNE from the site.

5) The origin of the stone material found at the excavation

Follows a list of the stone material found at the site.

1) The most frequent building stone is a bluish to light-grey fine grained siliceous limestone, sometimes marly, with calcite veins; rather easy to work. When angular in form, this stone has been quarried from the hard and compact layers of the complex of argillocists (“galestris”) and siliceous limestones (“palombini”), an undated Flysch formation from the Secondary period. Geological map sheet 128 “asc”, sheet 129 “ac” (see photo figure 33). Minimum distance from the site ca. 2 km, to the East.

![Figure 33: outcrop of the “galestrini e palombini” formation along the road between Cinigiano and Monticello, close to the junction for Castiglioncello.](image)

When in the form of decimetre sized rounded stones, the most likely find places are the beds of the larger rivers, which actually carry boulders of that size (see photo figure 34).
2) Less frequent is a very friable volcanic stone, rich in whitish transparent minerals and other inclusions. These derive from the “ignimbrites” of the acid M. Amiata volcanic complex, dated to the Early and Middle Pleistocene, sheet 129, i’ and i’’. Their aspect is described as generally tuffish-conglomeratic with angular elements. Minimum distance from the site ca. 12 km, to the East.

3) Less frequent is also a friable yellow sandstone with small white transparent micaeous inclusions. These derive from the “Serie Toscana” of the Secondary period. They are described as sandstones and sand-schists, and are known as “macigno”, sheet 128 “mg”. Generally not used as building material, since it is too friable. Minimum distance from the site ca. 6.5 km, to the West.

4) Rare is a hard reddish-grey crystalline sandstone. This may be derived from the quartz-calcareous sandstones of the “pietraforte” type, indicated on sheet 129 as “pt”’. But in the field we found this formation to be only of a dark grey colour. Minimum distance from the site ca. 5 km, to the East.

5) Very rare is a strongly weathered grey volcanic tuff with large white leucite crystals. This stone should belong to the leucite bearing lava’s of the Vulsini volcanic complex, which closest known outcrop is near Orvieto, at a distance of ca. 55 km. According to Antonelli et al. 2001 and Peacock 1980, in roman times this stone was widely used in Italy for carving millstones. At an excavation in Albano (Rome) I have seen a large conical millstones made of the same material. The bakery millstones of Ostia Antica may be of the same material; unfortunately the analyses performed by the Authors cited do not include millstones from Ostia.

6) Limited to the structures of roman age is a fine grained, hard, light coloured, tending to layered conglomerate, locally dark reddish (see photo figure 35).
The origin of this stone was not found. It may have been used as millstone. Interesting to note that I found a similar conglomerate at the S. Genesio excavation (University of Siena-Pisa); there it was also the only stone type which origin I was unable to identify; and it was surely used as a (flat round) millstone.
References


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