University Museum Monograph 116

A Central Asian Village at the Dawn of Civilization, Excavations at Anau, Turkmenistan

Fredrik T. Hiebert

with Kakamurad Kurbansakhatov

Foreword by Robert H. Dyson, Jr.

And contributions from Hubert Schmidt, Katherine M. Moore, Ogul'sona Lollekova, Langdon Warner, Naomi F. Miller, Alexandra Golyeva, N. M. Ermolova, Ann Forsten, James Adovasio, and Jeffery Illingworth

UNIVERSITY OF PENNSYLVANIA MUSEUM
of Archaeology and Anthropology

Philadelphia

2003

three skeletons indicates that one robust individual (presumed to be male) had an estimated stature of 170 cm. A second adult, interpreted as a female, had a stature estimated at 149 cm.

Given the period of study (1908), it is interesting to note that Mollison considered a racial diagnosis impossible "since in the bones of the extremities functional influences come so strongly into action that it is difficult to distinguish between peculiarities due to such functional action and those inherent in the race" (Mollison 1908:464).

As the analysis of the 1904 Anau materials proceeded, it is clear that Pumpelly found a racial explanation for the rise of civilization untestable and dropped his plan to include a chapter on "Aryans" in the 1908 volumes (Champlin 1994:193-198). Instead, he focused on describing the rise of a unique early civilization.

Conclusions Relating to Burials

The burials from Anau North documents the development of the informal interment within settlements—at least for some categories of persons—in the Early Village Period of Central Asia. At Anau South intramural burials continue through the Bronze Age and only end at the beginning of the Iron Age, where no burials have been encountered at all (Hiebert 1995, Warner 1908).

The burials under floors and in fill at Anau North indicate a private ritual with few burial goods, few formally constructed graves, and little evidence of social status of the individuals. We must keep in mind, however, that these burials represent a small sample taken from a limited area of the site, and the predominance of child burials in this sample underscores its narrowness. The fact that the burials within the settlement were mostly of children and sometimes contained whorls and beads suggests that these interments may have been predominantly women's activities. In any case, these burials, made within architectural spaces (and in period IIA, placed underneath the floors of rooms), indicate the close relationship of whomever performed the rite with the village space itself.

In contrast, fewer than 10% of the individuals interred at the Parkhai cemetery were children. This suggests that children were buried elsewhere, possibly at the still unexcavated village site itself, as at Anau. Conversely, the low incidence of intramural adult burials at Anau North, combined with the evidence from Parkhai, points to the possibility that separate, formal cemeteries constructed outside of the settlement area might be typical during the Early Village Period in Central Asia. If Anau had such a cemetery, however, it is likely to be deeply buried under the alluvium.

A pattern of intramural burials made just beneath floor levels is also found at both Ilgynli (Berezkin 1992) and Kara depe (Alekshin 1976) during Namazga II and III.

Such a burial pattern evokes a scenario where individuals would return to an abandoned area of the settlement or out-of-use room to bury kin or complete funerary rituals for kin already buried there. Our sample from Anau North shows that this tradition extends back to the beginning of the 5th millennium BC, during Anau IB1.

10

The Use of Plants at Anau North

Naomi F. Miller

A major goal of the 1997 excavation at Anau was to retrieve a chronological sequence of plant remains from archaeological strata that could be correlated with the earlier excavation of Kurbansakhatov on the north mound of Anau. The remains provide evidence for the state of the vegetation, fuel gathering, and agricultural practices.

Botanical and Archaeobotanical Background

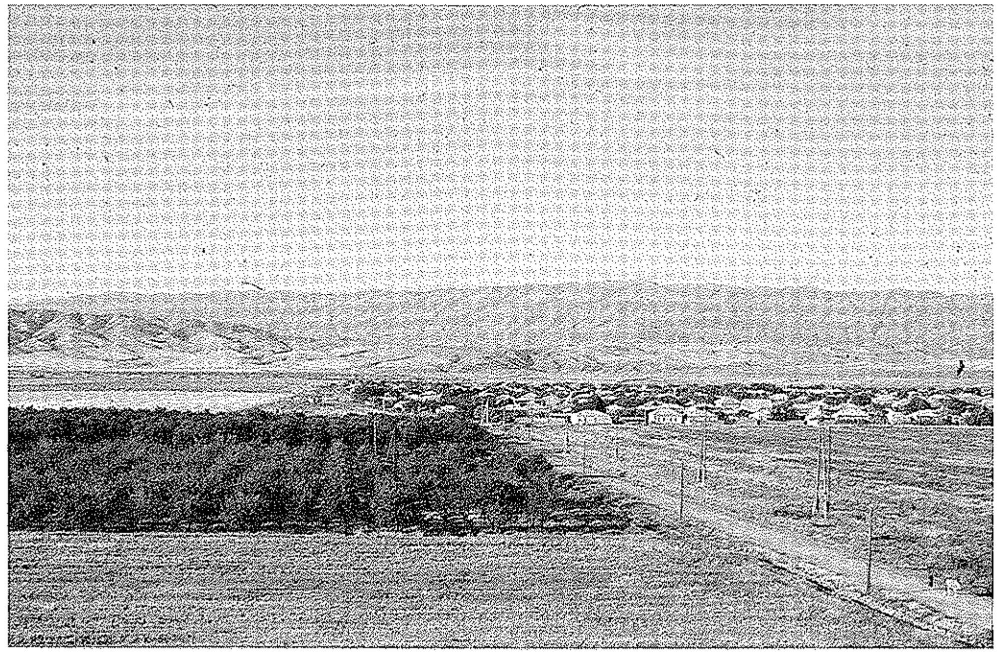
Irrigated grain fields (wheat and barley) and orchards (apricot, plum, apple, almond, quince) surrounded the site in 1997 (Figure 10.1). By 2000, the Anau collective farm had stopped caring for the trees; without irrigation, most died. Recent and present-day agriculture provide no model for vegetation and land use in antiquity. There are, however, some less disturbed areas within 20 km of the site. The following remarks are based on sources published in English and on some limited botanizing in the spring of 1994 and 1997; Dr. Antayev Eke Antayvich of the Institute of Botany in Ashgabat identified many of the voucher specimens; one of our assistants provided Turkmen plant names.

The distribution of vegetation on non-agricultural land tends to follow topographic bands, thanks to a fairly steep rainfall gradient between the Kopet Dag to the south and the desert to the north. Precipitation at the base of the Kopet Dag is as much as 350–450 mm but rapidly declines to the north on the piedmont plain; annual precipitation at Ashgabat is 230 mm (Orlovsky 1994: fig. 4, Table 5). Anau, situated only a few kilometers north of the mountains, was probably at or just outside the boundary for dry farming.

According to one of our Russian colleagues, until the construction of the Kara Kum Canal in the 1940s and subsequent increase in sedentary population, forest covered the Kopet Dag, even near Ashgabat. Today there are very few wild-growing trees in this region, except in the steep and inaccessible crevices of the mountains or along streams. With regard to the central Kopet Dag, Galina L. Kamakhina says that juniper was the major constituent of the lower mountain woodland in this area:

> [paleobotanists] have demonstrated that the cutting of junipers in the low northern foothills of Kopet Dag started as long ago as the 6th to 5th millennia BC. During the last 40 to 50 years, areas occupied by juniper woodlands have decreased by 30 to 40%; the total debit of water in mountain rivers has fallen by 50%; and many mountain springs have dried up. As a result, the altitudinal boundary of junipers has been elevated by 500 to 700 m from its ecological optimum, which has transformed many other plant communities. . . . The place of exterminated juniper woodlands was first occupied by mountain xerophytes, then by grasslands of *Elytrigia trichophora*, and finally by sagebrush [*Artemisia* sp.] and ephemeroid desert vegetation. (Kamakhina 1994: 145)

At the base of the mountains above Ashgabat on the road to Pöwrize, the landscape includes much bare rock, grasses, and small shrubs, and other evidences of



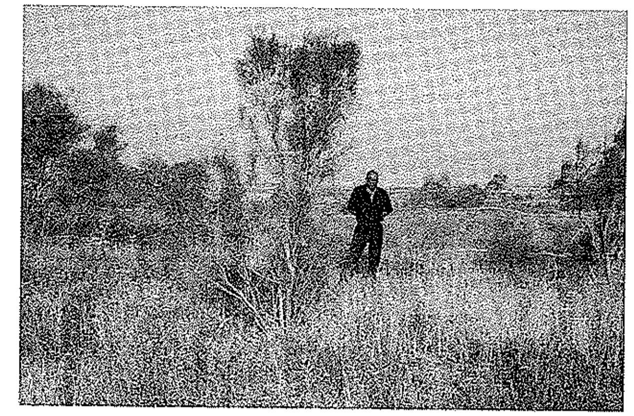
10.1. Vegetation of the Anau region , 1997 (compare with Figure 1.5c—same view in 1904).

grazing (Figure 10.2). Scattered small trees, mostly growing at the base of scarps where water can collect, include *Celtis caucasica* (hackberry), *Ficus* sp. (fig), *Cerasus microcarpa* (wild cherry=*it üzüm*, literally "dog grape") and *Ailanthus altissima* (tree-of-heaven). Shrubs covering the hillsides between grasses, other plants, and bare ground include *Lycium kopetdaghi*, *Capparis* sp. (caper=*go'ul*), *Zygophyllum fabago*, *Ephedra* sp., *Artemisia* sp. (wormwood). Along the stream, a popular picnic spot, grow trees such as *Ulmus carpinifolia* (elm=*garagach*, literally "black tree," as in Turkish), *Colutea atabajevii*, *Platanus* sp. (plane), *Morus* sp. (mulberry), and New World natives *Acer negundo* (box elder), *Catalpa*, cf. *Robinia pseudoacacia* (black locust).

In the foothills south of Anau, small shrubs (especially *Artemisia*) provide the only woody vegetation in a highly over-grazed landscape (Figure 10.3). Emerging from the foothills is a small stream, the Keltechinar, another popular picnic spot. The most common tree growing along the river is *Tamarix* (tamarisk=*yilgin*). There is also some *Salix* (willow) and *Ailanthus altissima*. In antiquity, the Keltechinar River ran out onto the plain not far from the site. Undisturbed, the characteristic *tugai* vegetation, which grows along the rivers as they flow through the foothills and lowlands, includes poplar (*Populus pruinosa*, *P. euphratica*), *Elaeagnus orientalis* and *Tamarix* (Popov 1994: 183). Unlike today, Syrian ash (*Fraxinus*

10.2. Riverine woodland in the Kopet Dag.

10.3. Kopet Dag scrub vegetation and sheep tracks.



10.4 Saksaul woodland at the edge of the desert.

syriaca) was once a significant component of *tugai* vegetation (Lisitsyna and Popov 1988, Popov 1994).

The first range of the Kopet Dag rises quite steeply in many places, but there is a narrow strip of rolling terrain that has enough moisture from rain or runoff to support shrubby vegetation. I was able to collect in one such spot a few minutes by car east of Anau (Figure 10.4). At least two shrubby types grow broadly interspersed among grasses–*Calligonum* sp. (=*ngandim*) and a member of the Chenopodiaceae (=*sazak*). These types, along with Haloxylon (= *saksaul*) and *Tamarix*, have greatly reduced leaves or green stems (presumably to reduce water loss). Many are also salt-tolerant. There are tracts of such shrubby steppe-desert vegetation along the main highway between Ashgabat and Namazga to the southeast. At the archaeological site of Abiverd, plants in bloom in mid-May included caper (*Capparis* cf. *spinosa*) and wild rue (*Peganum harmala*). The land between the base of the Kopet Dag and the desert to the north has probably changed from open woodland to grassland with scattered trees to steppe. Today, for example, the main vegetation on the Anau North Mound, which may be lightly grazed, consists of various grasses, including *Poa bulbosa* and *Hordeum murinum*.

Archaeobotanical Work during the 1997 Field Season

The earlier excavators at Anau North did recover some plant remains; ancient wheat and barley grains demonstrated that the inhabitants were agricultural people. Lisitsyna (1981) mentions bread wheat (*Triticum aestivum*) and two-row barley (*Hordeum vulgare* var. *distichum*) for Anau IB, layers 18–5. Relatively abundant quantities of wood charcoal suggested a richer botanical environment than today. The same summary fairly well describes the results of the current work (the 1997 samples are primarily *Hordeum vulgare* var. *vulgare*, six-row barley). Previously reported (Harrison and Miller 1995) and not yet analyzed material from the Bronze Age levels of the Anau South mound will enable us to trace even longer term change through time.

Sampling and Archaeological Contexts

First, reachable parts of the north and west baulk of Kurbansakhatov's excavation in sectors ANI–ANM were cleaned and drawn. It was possible to excavate up to a meter into the baulk of the upper strata in order to collect intact samples. The samples from this area were taken during the course of excavation from areas of obvious archaeological interest, like rooms and floors, not just because there was visible charcoal. Indeed, most of the samples can be tied to corresponding structures and areas recorded in Kurbansakhatov's earlier excavations. The Anau II deposits (layer 3) are represented by a few ash lenses and hearth deposits in ANI. Most of the samples were taken from Anau I deposits (layers 5–18) in ANJ, K, L, M, and N. In addition to ashy deposits, samples were taken from non-ashy deposits inside and outside several structures.

The earliest deposits were accessible only from the north and west baulks of ANN. To avoid contamination from falling debris from above, samples were extracted from the lowest layer to the highest. In ANN, soil samples were cut primarily from areas that were rich in charred material. Mean density of the ANN samples is therefore relatively high. Ancient functional context is more difficult to discern than in the later deposits. The chronological ordering of the upper and lower samples is reasonably straightforward, since most samples were excavated from at or near a clean section.

Sampling was designed to maximize the amount of botanical information for the volume of earth removed. An unfortunate but inevitable side effect of this strategy is that there is no comparable faunal assemblage to elucidate pastoral or hunting aspects of the economy; excavation was on just too small a scale. A second drawback is that archaeological context of some samples is not as clear as we would like. We can reasonably presume much of the material to be from redeposited hearth sweepings, but it is hard to evaluate a few anomalous samples. Even so, a remarkable number of samples can be directly tied to specific structures in the earlier excavation, and most of the charred remains seem to have come from secondary trash deposition. Details of these samples are presented in Appendix C, Tables C.1–C.9.

Deposits charred *in situ* are few; some of the hearths appear to have post-use fill. Only one other sample with a high density of charcoal (apparently from the rectangular building in layer 9, AN97.085), seems to be from a burnt room. Other deposits with a large amount of charcoal are ash lenses, perhaps hearth sweepings. There are no grain or other seed deposits. Most of the samples collected and analyzed come from trashy, ashy deposits. The charred remains are primarily fuel remnants (wood charcoal). Charred seeds probably come from burned dung and occasional crop-processing debris or other trash (Table C.1).

Flotation

Running water was not available, and a barrel flotation system was set up at the field laboratory. The volume of an entire soil sample was measured in a bucket with liter markings. A cup or two at a time, the soil was then poured into a large strainer lined with 1.0 mm mesh cloth. To speed the process, the large strainer was agitated. Floating material was scooped up with a tea strainer with a smaller mesh. For the most part, the soil dissolved quickly in water. When the tea strainer was full, it was emptied onto a cloth. The sample in cloth was hung up to dry in the shade. Bones, sherds, and other items from the heavy fraction were saved.

The Taxa

The archaeobotanical taxa are listed in alphabetical order by family in the data tables (Tables C.2, C.3, C.4). Table C.5 summarizes the assemblage, and Table C.6 presents some botanical and ecological information about the different types.

Cereals

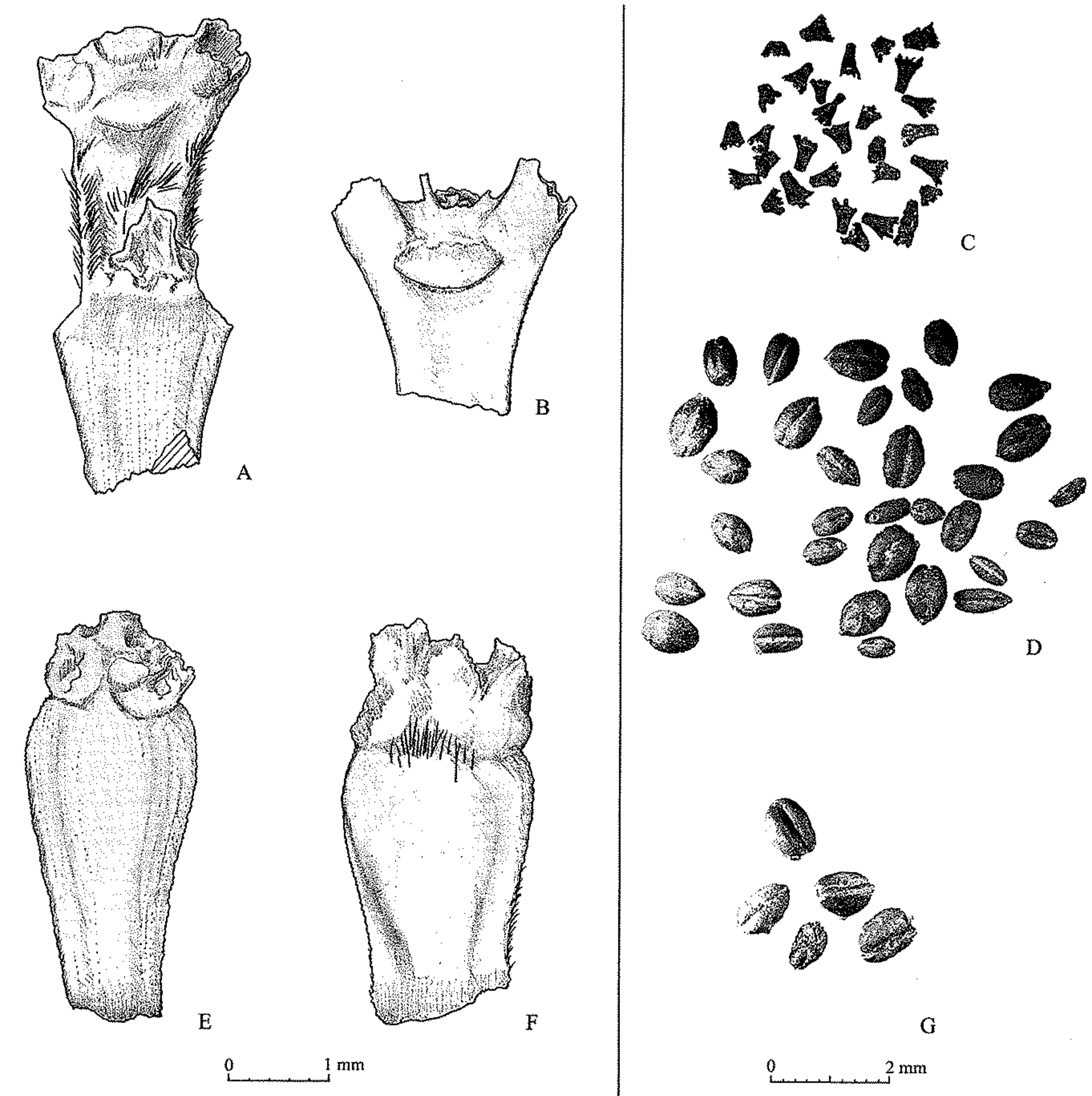
Hordeum vulgare var. *vulgare* **(six-row barley)**

The barley from the 1997 Anau North samples is the six-row type. The strongest case for this identification comes from the rachis internodes. Of the ones sufficiently well preserved to be identified, all are from the six-row type, with pedicellate (i.e., stalked) rather than sessile lateral spikelets (van Zeist and Palfenier-Vegter 1981:142) (Figures 10.5a–c). Also consistent with six-row barley is that many of the grains are twisted, but this characteristic is subtly expressed and in some cases could be the result of deformation during charring. The grains generally appear rather plump (Figure 10.5d), and they tend to be rounded in cross-section, which suggests the barley is naked rather than hulled. It is possible that some of the straight grains in our sample come from the two-row type. Indeed, Lisitsyna (1981) identified only two-row barley from the Anau samples she examined.

One sample, a dark lens from the earliest Anau IB level excavated (AN97.078), had a number of measurable barley grains (Table C.7). Compared to the six-row barley from other sites, these grains have a low length to breadth ratio (Table C.8). The glumes of hulled six-row barley seem to constrain the breadth but not the length of the grains, and so it is not surprising that the hulled grains from Yarym Tepe I (Bakhteyev and Yanushevich 1980), Karana 3 (Costantini and Costantini Biasini 1993), 'Oueili (Neff 1991), Ur (Ellison et al. 1978), and Tell Madhhur (Renfrew 1984) have higher L:B ratios than the naked barley of Anau. On the other hand, the Anau barley compares well with naked barley grains from the Iranian plateau (Costantini and Dyson 1990) and Pakistan (Costantini 1987). Measurements for Mehrgarh barley are not reported, but Costantini (Costantini 1984) describes it as having "small rounded seeds." The Anau grains are plumper than those of naked six-row barley from Erbaba, Turkey, a site where irrigation was not practiced (van Zeist and Buitenhuis 1983:63–64).

Triticum aestivum s.l. **(bread wheat)**

The characteristics of the wheat rachis internodes from Anau North point to bread wheat (Figure 10.5e,f); among the criteria mentioned by Hillman (1983 (nd)) which also describe our wheat internodes, are: (1) only the lowest part of the glume base is present ("glume-base deciduous"), (2) the nodes below the point of glume insertion are inconspicuous, (3) many are "conspicuously shield-shaped" and (4) many show "longitudinal lines near the outer edge of the convex face." The grains, like those of the barley in these samples, tend to be plump, but the number of grains is too small to provide meaningful measurements (Figure 10.5g).



10.5 Barley and wheat remains from Anau North, A–D, barley; E–G, wheat.

Fruits

Rosaceae, cf. *Prunus*

In AN97.005, a fragment of the base of a cf. *Prunus* has traces of an angular edge with longitudinal groove. The outer surface is relatively flat. Broadly defined, the genus *Prunus* includes plum, cherry, apricot, peach, and almond, and is closely related to Cerasus; the fragment is a little thinner than *Cerasus microcarpa*, a wild cherry that grows in the Kopet Dag, but otherwise resembles it.

Ulmaceae, Celtis **(hackberry)**

The most numerous tree fruit in the samples is *Celtis*, whose uncharred seeds were found in several deposits. The wood of *Celtis* was not encountered. Today, *Celtis* is to be part of the *shiblyak* vegetation (spiny xerophilous shrubs and grasses which replace overcut forest communities) between 800 m and 1600 m (Popov 1994: 179).

Celtis seeds have a high mineral content, frequently charring to a gray or white color, or they may be preserved uncharred. Therefore, they tend to be over-represented in archaeological samples. *Celtis* fruits are edible, and they also are eaten by birds. A large number of chambers of nesting birds punctuate the baulks of Anau North, to a depth of 10 cm or more. Even though the nesting holes in the baulks were cleared before archaeobotanical samples were taken, some of the *Celtis* might post-date the archaeological deposits in which they were found. Most, however, are most probably ancient, for this type is found in mineralized form in many Near Eastern archaeobotanical assemblages.

Wild and Weedy Plants

Of the genera and species of the small shrubs and herbs included in the wild and weedy category, few are unambiguously associated with particular habitats. Occasionally one can say that a particular taxon is likely to be either a field weed that thrives in disturbed agricultural soils or a plant of the steppe or steppe desert. The number of unidentified and tentatively identified types is higher than the author would like; she has not had much opportunity to develop a comparative collection for Turkmenistan. There are several types that are morphologically distinctive but nevertheless remain unidentified.

Apiaceae (Queen Anne's Lace Family)

Two seeds designated AN Apiaceae-1 are recorded (Figure 10.6a). Members of this family usually thrive in open areas. The family includes many weeds and steppe plants.

Asteraceae (Daisy/Thistle Family)

The Asteraceae is a large, diverse the plant family, which includes shrubs and herbs. Most of the members prefer open ground. Several members of this large family are recorded in the samples. One type, cf. *Artemisia* (wormwood), is a characteristic small shrub of the steppe-desert (Figure 10.6b). In more favorable climates, where the climax vegetation is grassland, it may be indicative of overgrazed pasture. It is eaten by herbivores. Today it was seen growing in degraded pasture in the foothills and front range of the Kopet Dag south of the site. A single seed was designated cf. *Taraxacum/Crepis* (i.e., dandelion or a similar plant). Not much can be said about the two small seeds designated AN Asteraceae-1. A second unidentified type, AN Asteraceae-2, is quite large, ca. 4 mm long; the seed has a smooth surface, is not angled, but is a little compressed, and the apex or base of the pappus is rounded. Of comparably large, smooth Asteraceae seeds that have been considered, this type is not *Centaurea* or a thistle (*Cirsium alatum*, *Picnomon acarna*, or *Carduus*), since all of those types have a ridge at the apex. Finally, the flower head of an Asteraceae was seen, but not further identified.

Boraginaceae (Borage Family)

Both of the boraginaceaous types in the assemblage are plants of open ground. *Heliotropium* is relatively common at Anau North; most of the seeds are under 1.5 mm in length, but a single longer one may be from a different species (Figure 10.6c). *Lithospermum* occurs occasionally in uncharred form. With a high mineral content, the seeds of this family are less subject to decay than most other types.

Brassicaceae (Mustard Family)

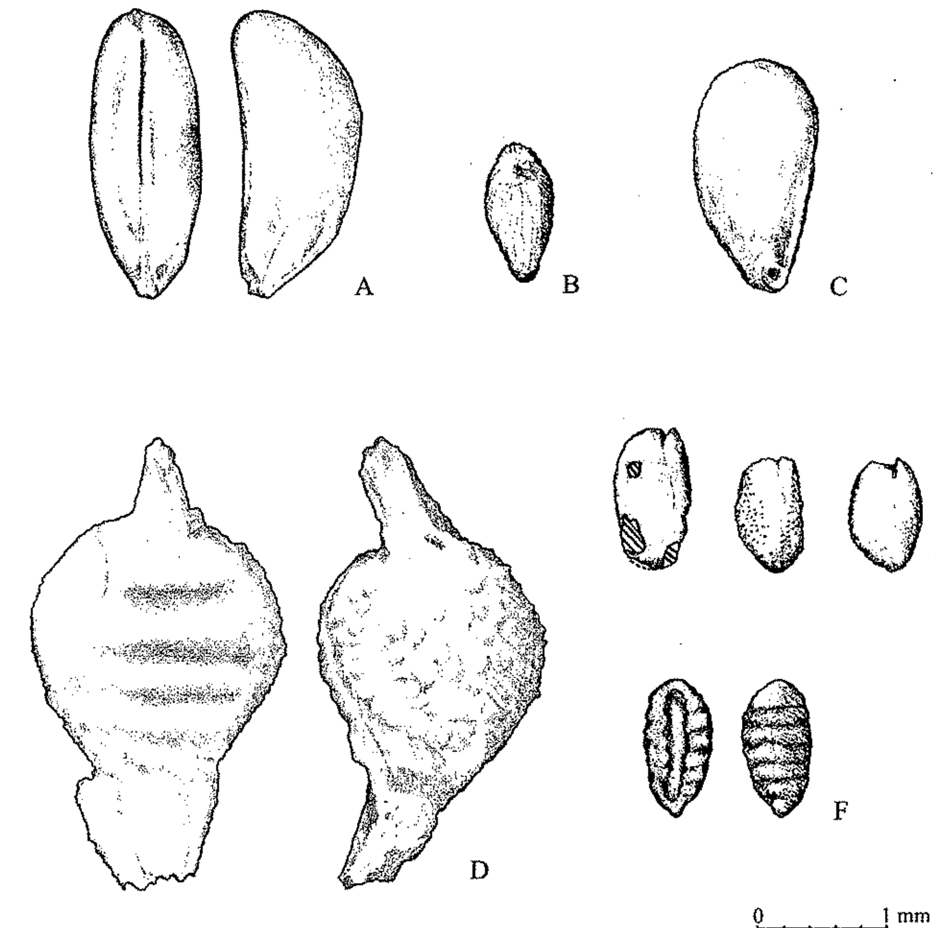
Members of the mustard family are commonly plants of field and steppe that are useful for fodder. A relatively flat seed type has been tentatively designated cf. *Alyssum* because it compares well with *Alyssum linifolium*. Siliques of *Euclidium syriacum*, a monotypic genus with indehiscent fruits, are quite common here, at Anau South (Harrison and Miller 1995), and at Gonur (designated Cruciferae 1 in Miller 1993) (Figure 10.6d). Another type closely resembles *Neslia* pictured by (van Zeist and Bakker-Heeres 1985:fig. 2.12). AN Brassicaceae-1 is the designation for a small oblong type which probably comes from a long, thin silique (Figure 10.6e).

Capparidaceae (Caper Family)

Most *Capparis* (caper) types are spiny shrubs. The fleshy fruits are edible for both people and animals, and in the Mediterranean world the buds and other parts of the plants are pickled, even the shoots. Seeds of *Capparis* occur in Anau IB and Anau IA levels.

Caryophyllaceae (Pink Family)

The pinks are usually small herbaceous plants; many are good fodder. A few seeds designated AN



10.6 Wild and weedy plants from Anau North.

Caryophyllaceae-1 were encountered, mostly in the lowest layer of Anau North (Figure 10.6f).

Chenopodiaceae (Goosefoot Family)

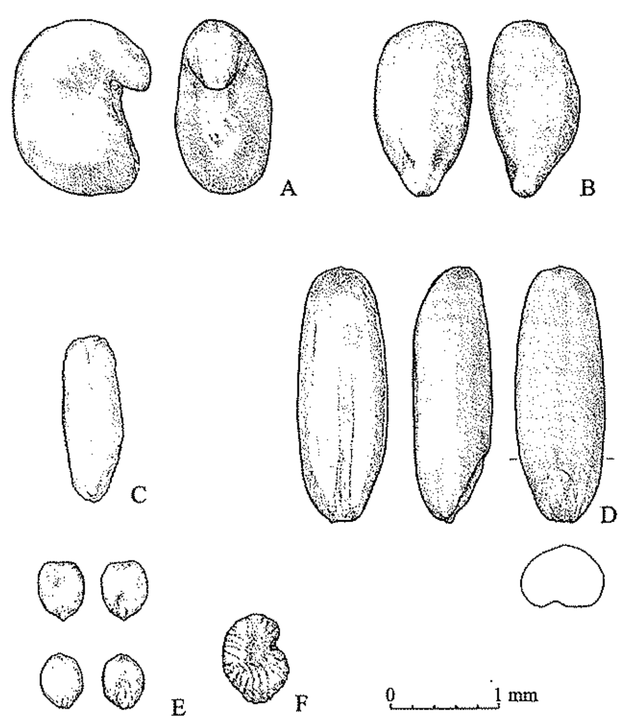
Members of this family include herbs and both small and tree like shrubs. Many are adapted to salty soils and open ground. *Atriplex* is represented in a single sample by two fruits encased in their bracts. Although unspecified Chenopodiaceous seeds occur in small quantities throughout the sequence, only a single *Chenopodium* was recognized (in an Anau IIA context). The most common of seeds of this family are cf. *Salsola*, distinguished by a curled embryo that is relatively flat, and so not quite like the *Salsola* depicted by van Zeist and Bakker-Heeres (van Zeist and Bakker-Heeres 1985:fig. 8). In addition, a few *Suaeda* seeds have been tentatively identified from the Anau IB layers.

Cyperaceae (Sedge Family)

The sedges are typically plants of relatively moist open ground: the sides of streams and ditches, swales, marshy areas. *Carex* and *Scirpus* have been tentatively identified, along with two other types: AN Cyperaceae-1 and AN Cyperaceae-2. They occur in small quantities in layer 8 and below.

Fabaceae (Legume/Clover Family)

Leguminous plants are found in all kinds of habitats and growth forms. Many of the legumes provide very good fodder and are characteristic of undegraded steppe. With a few exceptions, distinguishing genera from seeds alone is problematic. Two samples had some pod segments of *Alhagi* (camelthorn), which is a small spiny shrub with a very deep tap root that thrives in fallow fields and overgrazed pasture. *Alhagi* has been found in greater quanti-



10.7 Wild and weedy plants from Anau North (cont).

ties on the Iranian plateau at 4th millennium Hissar (Costantini and Dyson 1990) and 3rd millennium Gijlar (Costantini and Biasini 1984). *Astragalus* and possible *Trifolium/Melilotus* (clover/melilot) occur at various points in the sequence. One of the most frequently occurring and numerous types in the assemblage is *Trigonella*, though more than 85% of the 1672 *Trigonella* seeds come from a single sample, 97.078 (layer 18). *Trigonella*, *Trifolium/Melilotus*, and *Astragalus* all provide high-quality forage. Finally, one-as-yet unidentified legume is designated AN Fabaceae-1 (Figure 10.7a).

Lamiaceae (Mint Family)

The mints comprise another widespread and diverse family whose members thrive in a variety of habitats. Though scattered throughout the sequence, the total number of seeds of this family is small. Only one has been tentatively designated to a genus, *Ziziphora*. Three more seem distinctive, but are not in the comparative collection at MASCA, AN Lamiaceae-1 (Figure 10.7b), AN Lamiaceae-2 and AN Lamiaceae-3 (Figure 10.7c).

Liliaceae (Lily Family)

There is not much to say about two rare types, one of which may not even be a member of the lily family (AN cf. Liliaceae-1). It is clear that more comparative material would be invaluable.

Poaceae (Grass Family)

Grassy steppe with scattered trees probably would have characterized the land between the foothills to the south and desert to the north. Indeed, many of the "wild and weedy" plants mentioned in this section could have grown interspersed among the grasses, which themselves probably grew between sparsely distributed trees. As grasses provide good pasture, it is probably no accident that they, along with the legumes, comprise the most important component of the archaeobotanical assemblage. Of the identified grasses, *Aegilops* is most numerous and occurs in the largest number of samples. Like the *Aegilops* seeds, the glume bases are most prominent in the Anau IA samples (layers 19 and 20). The remaining identified grasses (cf. *Bromus*, *Phleum/Eragrostis*, *Eremopyrum*, *Hordeum murinum*-type, and cf. *Setaria*) occur in very small quantities and percentages. *Phleum/Eragrostis* designates a very small (less than 0.1 mm long) almost elliptical seed. *Eremopyrum* is keeled on the dorsal side. *Hordeum murinum*-type is similar in shape to domesticated two-row barley, but is quite a bit smaller. There are also quite a number of unidentified (AN Poaceae-1 to -8) (Figure 10.7d) and unidentifiable types. AN Poaceae-1 is a significant part of the assemblage. It is very similar in shape to *Setaria*, but is quite small, well under 1.0 mm long (Figure 10.7e).

Fumaricaceae (Fumitory Family)

Fumaria, a small herbaceous plant eaten by animals, is represented by a total of two seeds.

Portulacaceae (Purslane Family)

A single tentatively identified *Portulaca* (purslane) seed was seen. Portulaca has a succulent leaf and the greens are very tasty in salad or cooked. The Turkmen name is *semzik* (*semizotu* in Turkish).

Primulaceae

Two deposits provided a total of four *Androsace* seeds.

Ranunculaceae (Buttercup Family)

Two members of the buttercup family were encountered, both of which are plants of open ground, *Adonis* and *Ceratocephalus*.

Rubiaceae

Galium has a consistent though low presence here.

Unidentified Types

There are several unknown types. The most distinctive, AN unknown-3, is illustrated in Figure 10.7f.

Woody Plant Taxa (Charcoal)

For discussion of the distribution of these types today, see discussion of modern vegetation above.

Cupressaceae

Three pieces identified as *Juniperus* (juniper) were encountered. They had no resin ducts. The pits seemed to be cupressoid. A fourth piece at first looked like it had a resin duct, but the absence of fenestroid pits and, more importantly, the absence of pine in the forests of Turkmenistan (Kurbanov 1994: 107) encouraged a reconsideration; it is listed as "conifer" in Tables C.3 and C.4, and the "resin duct" may be a hole made by a rootlet.

Chenopodiaceae

A few pieces of Chenopodiaceous charcoal were identified. One type looked like *Haloxylon* depicted by Fahn et al. (1985). It also compared well with the unvouchered "saksaul" given to me at a picnic; "saksaul" is the common Turkmen word for *Haloxylon*, which can grow to the size of a small tree. The other type compared well with the wood of a vouchered small shrub called "sazak" by our driver, a Turkmen (though not yet identified, *Arthrocnemum*, *Halocnemum*, and *Anabasis* are under consideration; this type is not *Salsola dendroides*, also called "sazak" by our driver).

Oleaceae

Two pieces of *Fraxinus* (ash) were identified from the earliest layer. Ash would have been a constituent of *tugai* (riparian thicket) vegetation of the Keltechinar river valley.

Salicaceae

Populus/Salix (poplar/willow) was identified from vessel and ray pattern in cross section only. The radial section of three pieces in AN97.085 seemed to be homocellular, which supports an identification of poplar. (The identification is difficult because the rays of poplar and willow are so narrow it is difficult to get a clear view.) Poplar would have been a constituent of *tugai* vegetation.

Tamaricaceae

Tamarix (along with cf. *Tamarix*) is the most important wood in the charcoal assemblage, comprising over 71 to 94% by count and weight of the charcoal indentified in each phase. It is present in all samples examined. In addition to vessel pattern and ray width visible in cross section, where possible I checked the radial section for storied vessels and parenchyma and heterocellular rays (procumbent, upright, and square cells). Tamarisk would have grown along the Keltechinar river, as it does today.

Animal Dung

Fragments of animal dung occur, sometimes clearly charred (Table C.9). Dung fragments have a fibrous texture. Occasionally enough of the outer shape and texture is preserved to recognize fragmentary or whole sheep/goat pellet. In at least one sample, the laminar structure of the fibrous remains suggests stable litter; even today at Anau kolkhoz the accumulated dung of penned sheep and goats is periodically dug out in flattened chunks that makes a very good fuel. Judging from the overall high densities and proportions of wood charcoal in the samples, animal dung was at most a minor, supplemental fuel.

Three samples are noteworthy for having fairly dense dung-like deposits:

1. AN97.031, layer 3 was from a burnt floor in a structure. It has a low density of charred material, so it may just be a from a room that was swept clean.

2. AN97.045, layer 14 is from a burnt layer inside a round, c. 1.4 m diameter structure. It has a low density of charred material. The control sample (AN97.036) from outside the building had a similar low density of material, but no evidence of dung use, either.

3. AN97.073, layer 19 has a moderate density of charred material.

A fourth sample discussed below, AN97.078 from layer 18, has a moderate density of charred material that includes a substantial amount of sheep/goat dung pellets and fragments.

Analysis

Taphonomy

Most plant materials at Anau were preserved by charring. For that reason it is likely that the charred wood and seeds come primarily from fuel—wood, brush, and dung (Miller 1984)—though accidental inclusions of some material cannot be excluded. Most of the deposits with high densities of material are redeposited rather than burned in place. Only one high-density deposit is likely to have come from a burnt building, and so is not comparable to the others.

Quantification

Like individual potsherds, individual seeds are interpretable only at the most basic level (identity, ecological requirements of the taxon, likely source). Similarly, one may identify a sample from a single deposit as, say, a hearth deposit, if stratigraphic and contextual information supports the interpretation, but it is really not possible to evaluate one sample in isolation from others of the assemblage. For example, if we do not know what charcoal densities to expect for cultural fill, how can we know if a hearth deposit has *in situ* fuel remains or just some background amount of charcoal? On the other hand, at many sites the variability between samples is so high as to make average values meaningless. There are, however, quantitative ways of considering the samples that can be useful.

Density

For purposes of this report, "density" is measured by the weight in grams—of charred plant material (wood, seeds, other parts) caught in a 2-mm sieve—per liter of soil. Because the bulk of the burned material is wood, samples with a high density of charred material tend to have a lot of wood charcoal. Samples with overall low densities of material cannot really be interpreted, since the charred material probably consists of "background noise" rather than some kind of *in situ* deposit.

Seed-to-Charcoal Ratio

Two forms of this measure are the proportion by weight of seed material larger than 2 mm (essentially cereal) to charcoal larger than 2 mm, and the proportion of wild and weedy seeds (by count) to weight of charcoal. I suggest that both help us assess the relative amounts of dung-to-wood fuel in the assemblage. As the number of seeds in dung is seasonally variable (Bottema 1984), this measure is only applicable to groups of samples. At Anau, both proportions are relatively low (Table C.5), and are close to the proportions found in samples at Malyan, in the heart of the Zagros forest zone, with average ratios of under 0.05 (by weight) for seed material and about 8 wild and weedy seeds per gram of charcoal (Miller 1982, 1990). Those numbers are quite different from the site of Hacinebi in southeastern Turkey (the comparable ratios are 0.46 by seed weight and 281 by seed number; data in Miller 1996). That is, dung supplemented wood fuel at Anau, but was relatively unimportant.

Wild and Weedy-to-Cereal Ratio

Insofar as the seeds originated in dung fuel, the values of this ratio could be used to assess reliance on pasture relative to cultivated fodder (Miller 1998). This figure at Anau is not that useful, because random factors of sampling interfere with interpretation with such small amounts of seed material.

Spatial Distribution

Of the four hearth deposits sampled, two (AN97.002, AN97.006) have moderate densities of charred material, almost entirely wood charcoal, and two (AN97.013, AN97.035), with low densities of charcoal, are more likely to have post-abandonment trash.

Most of the samples from layers 3 to 18 can be directly related to structures and other deposits in the 1978–1982 excavations. The Anau IB round structures could have been used for storage or animal pens. Only one such structure (AN97.045, layer 14) had *in situ* evidence for dung and a low density of charred material, which strongly supports the view that it was an animal pen. The material in other round structures appears to be trash deposited after the buildings' abandonment; it is likely, though not provable, that they, too, were animal pens.

The sample from a square structure (97.085) in layer 7 has a very low density of seed remains, but quite a bit of wood charcoal and reed culm nodes. The charcoal includes many large chunks (about 1.5 cm) of poplar and tamarisk. Long straight poplar poles are a common source of roof beams in Iran and Afghanistan Reeds are layered between the beams and mud roof plaster (Szabo and Barfield 1991: 135–37). It thus seems likely that this deposit is primarily fallen roof debris mixed in with stored firewood or furnishings.

One sample, AN97.078, stands out. Along with quite a bit of charred sheep/goat dung, there was a tremendous number of wild seeds—more than half the seeds in the wild-and-weedy category come from this one sample (2399 out of 4290 total)—and the most grain (barley) and charred dung (Table C.9) of any sample examined. Most of the wild seeds were of *Trigonella*. Although this sample has a high proportion of seed (both wild and domesticated) relative to charcoal, the proportion of wild seed to cereal is close to the median for the assemblage. Described as a "dark lens outside of architecture," the deposit could just be an undisturbed ash dump from a domestic hearth that provided the only sample in the entire assemblage with substantial remains of dung fuel.

Finally, one might consider the sample from the very bottom of the excavation in ANN in layer 20. At first, we thought the deposit had no occupation debris, but flotation revealed a small amount of wood charcoal, along with a well-preserved barley grain. It is unlikely that any of this material is intrusive. Subsequent to the excavation, Hiebert discovered some notes of Pumpelly that documented an extension of the site below the modern plain. Therefore, sterile soil was not reached in this part of the excavation.

Vegetation, Agriculture, and Landscape

Originating as fuel, the charcoal assemblage is the best evidence for woody vegetation growing near the site. The importance of wood charcoal and predominance of tamarisk strongly suggests the inhabitants of Anau had easy access to *tugai* vegetation. This is not surprising, as until recently this was the typical plant cover along streams like the Keltechinar. Ash (*Fraxinus*), which seems to have largely disappeared by the Bronze Age (Lisitsyna and Popov 1988), comes only from the earliest excavated layer. Poplar, too, would have formed part of this association. These taxa constitute at least 85% of the charcoal assemblage by count or weight in all periods. This suggests that *tugai* vegetation grew near Anau. Evidence for dung fuel use (the seed:charcoal ratio) supports the view that the human impact on the vegetation was negligible; it does not change much between Anau IA and Anau IB phases.

Two upland forest products, juniper and cf. *Prunus*, are absent in the Anau I deposits. Similarly, the Chenopodiaceous shrubs from the steppe or degraded pasture are more prevalent in the later phases. Although the data are too scanty to make firm pronouncements, they suggest that the Anau IB residents were more likely to go further afield for fuel gathering. In the case of the Chenopodiaceous woods, perhaps grazing or land clearance for agriculture or fuel increased the area of degraded pasture.

The settlement history of Turkmenistan from Neolithic times on cannot be understood without a consideration of the water supply for farming. Anau is situated at the very edge of the rainfall agriculture zone, so irrigation could have been an important factor enhancing crop security. Watering practices are reflected in archaeological crop remains thanks to ancient crop choice and the way the seeds of those plants respond to moisture conditions.

Some crop types are more drought tolerant than others. For example, due to its shorter growing season, under rainfed conditions, barley tends to need less water than wheat, and two-row barley needs less water than the six-row type. Where both two- and six-row barley are grown, and irrigation is practiced, six-row is more likely to be irrigated (Harlan 1968). The wheats, too, vary in their moisture requirements. Hans Helbaek (1969) considered the arrival of bread wheat (*Triticum aestivum*) on the Deh Luran plain in Iran as evidence of irrigation. In the semi-arid environs of Anau, six-row barley and bread wheat would not be the most likely crops under rainfed conditions. Not only is precipitation rather low for dry-farming, but both of these crops have a relatively high water requirement compared to alternatives, like two-row barley or, as had been grown earlier at Djeitun, einkorn wheat (Harris et al. 1996). A second bit of evidence is grain shape; with irrigation, grains tend to get plumper. As discussed above with regard to barley, the Anau grains have a low length to breadth ratio compared to those at other sites. Therefore, the main crops evidenced to date at Anau North, six-row barley and bread wheat, almost undoubtedly were irrigated, perhaps by simple gravity flow (see Miller 1999).

In summary, the people of Anau settled in a landscape dominated by renewable *tugai* vegetation. Fields probably were cleared along the stream, perhaps interspersed with *tugai* thickets, and herds grazed on nearby steppe. Human activities had only a negligible impact on the vegetation in the period considered here. Over time, however, fields may have expanded at the expense of pasture and *tugai* in the immediate vicinity of the settlement.

11

Microscopic Analysis of Soils from Anau North

Alexandra A. Golyeva

In Russian soil science "biomorphic analysis" refers to the combined study of phytoliths, spores, pollen, diatoms, sponge spicules, cuticle casts, detritus, and other microscopic plant parts (Golyeva 1997). Most soils—including natural strata, plowed fields, pastures, and cultural layers—contain different and distinctive arrays of these microscopic plant remains. The primary purpose of biomorphic analysis in Russian soil science is the determination of evolutionary trends of soils and anthropogenic sediments and the determination of modern and past environmental conditions. For archaeological purposes, a combined biomorphic analysis increases the reliability of individual data and truthfulness of the reconstruction of a behavioral activity or depositional context (Table 11.1). This approach combines paleoethnobotanical techniques (Pearsall 1989) with the study of detritus and grain size as used in soil micromorphological studies (Courty et al. 1989).

While this type of analysis has been developed to study naturally deposited soils, its application in archaeology is being developed in the steppe regions of

Table 11.1 Inferences from Biomorphic Data

Biomorphic data	**Potential interpretations from archaeological samples**
Pollen and spores	Composition of local flora, plant use information, season in which the soil was buried
Phytoliths	Plant use information, indication of anthropomorphic disturbances, erosional processes, character of irrigation systems, nature or function of specific contexts, use of cereal plant parts
Diatoms and sponge spicules	Relative indicator of the use of water adapted plants
Silicified cuticle casts	Indication of rapid soil burying
Charcoal and xylem	Identification of burning, and near-by hearths, open or closed areas from winds, indication of cultural layers, composition of economically important woods
Detritus	Diagnostic of cultural layers and surface layers, indication of the nature and intensity of post-depositional modification (crushing)

Table B.1 cont.

Description	Material	Excavation Unit	Date	Index no. (Schmidt 1908)	Period	Context (Appendix A)
Piece of marble	Stone	T VII	7-Apr-1904	204	IB2	T7.10
Polishing stone	Stone	T VII	7-Apr-1904	205	IB2	T7.10
Marble of stone	Stone	T VII	5-Apr-1904	127	IIA	T7.6
Ball of uncertain material, burial object of disturbed skeleton		T II	5-Apr-1904	143	IB2	T2.8
Marble		West gallery shaft "well"	2-Apr-1904	90	IA	WG.8

Appendix C
Botanical Data from the 1997 Excavations

Naomi F. Miller

Table C.1. Catalog of Flotation Samples Discussed in this Report

layer	locus	flot. no.	
3	ANI 9	31	burnt level beneath ANI/6; inside?
3	ANI 11	2	hearth over pit; dark soil
3	ANI 13	5	mud brick/burnt/ashy layer (bag 3)
3	ANI 13	6	hearth; dark soil
3	ANI 15	9	ashy room fill west of wall
5	ANK 3	25	build-up above surface, waterlain? see AN97.026
5	ANK 3	26	build-up above surface, waterlain? see AN97.025
5	ANJ 5	10	area 3, floor deposits with small hearth
5	ANJ 6	13	hearth, see AN97.010
6	ANK 8	23	area 3; upper clean fill above surf. (west) (bag 1)
6	ANK 11	22	area 3; fill above surface, very clean
6	ANK 12	21	area 3; fill above surface
6	ANK 16	17	fill just above ANK/17 surface (bag 1)
6	ANK 17	15	material above ashy surface
8	ANL 4	28	upper fill near oven
8	ANL 4	29	upper fill near oven
8	ANL 7	30	above floor (painted) of lower architecture
9	ANL 32	85	inside rectangular bldg
11	ANL 31	84	inside later circular bldg
12	ANL 30	83	inside earlier circular bldg
14	ANM 2	32	courtyard surface w/ some ash
14	ANM 3	34	red surface layer inside circular structure
14	ANM 6	35	hearth, on red surface inside circular structure
14	ANM 6	36	outside circular structure; sandy surface
14	ANM 7	37	inside circular structure (gray layer, bag 2)
14	ANM 9	40	inside circular structure (ashy fill)
14	ANM 11	45	inside circular structure (burnt layer)
16	ANN 29	82	ashy deposit on living floor
18	ANN 28	81	laminar gray-brown or 17-lower
18	ANN 24	77	ashy deposit
18	ANN 23	78	dark lens outside of archit.; earliest Anau IB1
19	ANN 10	63	ashy floor
19	ANN 13	67	upper ashy lens
19	ANN 17	72	trashy ashy lens; pit?
19	ANN 18	73	charcoal lens near pit
19	ANN 19	74	topmost ashy charcoal layer
19	ANN 21	75	topmost deposit of layer 19
19	ANN 11	64	ashy lens in fill
20	ANN 07	60	upper fill inside bldg
20	ANN 02	57	inside bldg; lowest archit. level
20	ANN 27	66	outside room
"sterile"	ANN 01	56	deep sounding

Table C.2. Plant remains from Anau North

Layer Section Locus Sample no.	3 AN.I 9 97.031	3 AN.I 11 97.002	3 AN.I 13 97.005	3 AN.I 13 97.006	3 AN.I 15 97.009	5 AN.K 3 97.025	5 AN.K 3 97.026	5 AN.J 5 97.010	5 AN.J 6 97.013	6 AN.K 8 97.023	6 AN.K 11 97.022
volume (l)	10	8	9	3	8	8	11	12	8	8	8
charcoal (>2mm; g)	8.69	15.06	21.18	16.92	1.07	2.58	0.64	6.89	5.77	3.67	1.72
seed (>2mm; g)	0.18	0.02	0.04	0.01	.	+	.	0.27	0.02	0.02	0.03
misc (>2mm; g)	+	0.01	.	.	.	.	+	0.01	0.02	0.01	.
wild & weedy (#)	342	21	4	1	1	8	.	88	90	8	5
density	0.89	1.89	2.36	5.64	0.13	0.32	0.06	0.60	0.73	0.46	0.22
seed/charcoal	0.021	0.001	0.002	0.001	+	+	.	0.039	0.003	0.005	0.017
wild & weedy/charcoal	39.36	1.39	0.19	0.06	0.93	3.10	.	12.77	15.60	2.18	2.91
Food plants											
Hordeum	0.10	0.01	.	0.01	.	+	.	0.01	.	0.01	0.02
Triticum aestivum	0.04	.	.	.	.	.	.	0.03	0.01	0.01	.
Triticum sp.	.	.	.	.	.	.	.	.	.	.	.
Cereal	0.07	0.01	0.01	+	+	.	.	0.03	+		0.02
cf. *Prunus*/Rosac.	.	.	0.03	.	.	.	.	.	.	+	.
cf. *Vitis*	.	.	.	.	.	.	.	.	.	.	.
nutshell?	.	.	.	.	.	.	.	.	.	.	.
cf. pulse	5	.	.	.	.	.	.	.	.	.	.
Wild & weedy											
AN Apiaceae-1	.	.	.	.	.	.	.	.	.	.	.
cf. *Artemisia*	.	.	.	.	.	.	.	.	.	.	.
cf. *Taraxacum/Crepis*	1	.	.	.	.	.	.	.	.	.	.
AN Asteraceae-1	.	.	.	.	.	.	.	1	.	.	.
AN Asteraceae-2	1	.	.	.	.	.	.	.	.	.	.
Asteraceae indet.	.	.	.	.	.	.	.	1	.	.	.
Heliotropium-1	1	1	.	.	.	.	.	1	1	.	1
Heliotropium-2	.	.	.	.	.	.	.	.	.	.	1
cf. *Alyssum*	5	.	.	.	.	.	.	1	.	.	.
cf. *Neslia*	.	1	.	.	.	.	.	.	.	.	.
AN Brassicaceae-1	2	.	.	.	.	.	.	.	3	.	.
Brassicaceae indet.	.	.	.	.	.	.	.	.	.	.	.
Capparis	2	.	.	.	.	.	.	7	.	.	.
AN Caryophyllaceae-1	.	.	.	.	.	.	.	.	.	.	.
cf. *Chenopodium*	.	1	.	.	.	.	.	.	.	.	.
cf. *Salsola*	.	.	1	1	.	.	.	2	2	1	.
cf. *Suaeda*	.	.	.	.	.	.	.	2	.	.	.
Chenopodiaceae	.	.	.	.	.	.	.	.	.	.	.
cf. *Carex*	2	.	.	.	.	.	.	.	.	.	.
cf. *Scirpus*	2	.	.	.	.	.	.	.	.	.	.
AN Cyperaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Cyperaceae-2	.	.	.	.	.	.	.	.	.	.	.
Cyperaceae/*Polygonum*	.	.	.	.	.	.	.	.	.	.	.
Cyperaceae indet.	.	.	.	.	.	.	.	.	.	.	.
cf. *Alhagi*	.	.	.	.	.	.	.	.	.	.	.
Astragalus	.	1	.	.	.	.	.	1	.	.	.
Trifolium/Melilotus	.	.	.	.	.	.	.	1	.	.	.
Trigonella	.	.	.	.	.	.	.	3	10	1	.
AN Fabaceae-1	.	.	.	.	.	.	.	.	2	.	.
Fabaceae indet.	.	1	.	.	1	.	.	1	9	1	.
cf. *Ziziphora*	.	3	2	.	.	.	.	.	.	.	.
AN Lamiaceae-1	.	1	.	.	.	.	.	.	.	.	.
AN Lamiaceae-2	.	.	.	.	.	.	.	.	.	.	.
AN Lamiaceae-3	.	.	.	.	.	.	.	.	.	.	.
Lamiaceae indet.	.	.	.	.	.	.	.	.	.	.	.
AN cf. Liliaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Liliaceae-2	.	.	.	.	.	.	.	.	.	.	.
Aegilops	2	.	.	.	.	.	.	.	.	.	.
cf. *Bromus*	.	.	.	.	.	.	.	.	1	.	1
Eremopyrum	.	3	.	.	.	.	.	.	.	.	.
Hordeum murinum-type	2	1	.	.	.	.	.	.	.	.	.
Phleum/Eragrostis	.	.	.	.	.	.	.	.	.	.	.
cf. *Setaria*	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-1	283	1	.	.	.	4	.	3	45	.	.
AN Poaceae-2	.	1	.	.	.	.	.	.	.	.	.
AN Poaceae-3	.	.	.	.	.	.	.	1	.	.	.
AN Poaceae-4	.	.	.	.	.	1	.	.	.	.	.
AN Poaceae-5	4	.	.	.	.	.	.	.	.	.	.
AN Poaceae-6	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-7	.	.	.	.	.	.	.	.	.	.	.
Poaceae indet.	10	2	1	.	.	2	.	3	2	1	.
Fumaria	1	.	.	.	.	.	.	.	1	.	.
cf. *Portulaca*	.	.	.	.	.	.	.	.	.	.	.
Androsace	.	.	.	.	.	.	.	2	.	.	.
Adonis	1	1	.	.	.	.	.	.	.	.	1
Ceratocephalus	.	.	.	.	.	1	.	.	4	.	.
Galium	2	.	.	.	.	.	.	1	.	3	.
AN unknown-1	.	.	.	.	.	.	.	40	.	.	.
AN unknown-2	.	.	.	.	.	.	.	5	.	.	.
AN unknown-3	.	.	.	.	.	.	.	.	1	.	.
AN unknown-5	.	.	.	.	.	.	.	.	.	1	1
AN unknown-8	.	.	.	.	.	.	.	.	.	.	.
unknown	21	3	.	.	.	.	.	12	9	.	.
Plant parts											
Asteraceae capitulum	.	.	.	.	.	.	.	.	.	.	.
Euclidium	.	.	.	1	.	.	.	1	4	.	.
silique frag, AN Brassicaceae-1	.	.	.	.	.	.	.	.	.	.	.
Atriplex fruit	.	.	.	.	.	.	.	.	.	.	.
Alhagi pod segment	.	.	.	.	.	.	.	.	.	.	.
Hordeum vulgare var. *hexastichum* internode	6	1	.	.	.	2	8	38	6	15	5
Hordeum vulgare internode	3	.	.	.	1	.	.	48	5	6	4
Triticum internode	2	1	.	.	1	.	.	7	39	.	.
Aegilops glume base	5	.	.	.	.	.	.	8		3	1
Poaceae culm node	.	.	.	.	.	.	.	2	6	.	.
cf. *Phragmites* culm node	.	.	.	.	.	.	.	.	.	.	.
unknown	2	.	.	.	.	.	.	.	.	1	.
Uncharred											
Celtis	.	1	.	+	0.5	.	.	34	4	.	0.5
Lithospermum	.	.	.	.	.	.	.	.	.	.	.
mineralized seed	.	.	.	.	.	.	.	.	.	.	.

Table C.2, cont.

Layer	6	6	6	8-upper	8-upper	8-lower	9	11	12	14	14
Section	**AN.K**	**AN.K**	**AN.K**	**AN.L**	**AN.L**	**AN.L**	**AN.L**	**AN.L**	**AN.L**	**AN.M**	**AN.M**
Locus	**12**	**16**	**17**	**4**	**4**	**7**	**5.14.32**	**5.14.31**	**5.14.30**	**2**	**3**
Sample no.	**97.021**	**97.017**	**97.015**	**97.028**	**97.029**	**97.030**	**97.085**	**97.084**	**97.083**	**97.032**	**97.034**
volume (l)	8	10	7	9	11	6	4	4	7	7	8
charcoal (>2mm; g)	0.80	2.22	0.56	15.43	8.94	4.07	38.96	30.47	26.33	6.62	12.36
seed (>2mm; g)	.	0.01	+	+	0.03	+	+	.	0.02	0.09	0.06
misc (>2mm; g)	.	.	.	0.02	.	0.01	2.38	0.04	0.02	0.05	0.01
wild & weedy (#)	.	6	4	57	11	2	2	.	8	58	64
density	0.10	0.22	0.08	1.72	0.82	0.68	10.34	7.63	3.77	0.97	1.55
seed/charcoal	.	0.004	+	+	0.003	+	+	.	0.001	0.014	0.005
wild & weedy/charcoal	.	2.70	7.14	3.69	1.23	0.49	0.05	.	0.30	8.76	5.18
<u>Food plants</u>											
Hordeum	.	+	.	.	0.01	0.02	.	0.01	+	0.02	0.02
Triticum aestivum	.	+	.	.	0.01	.	.	+	.	0.02	0.01
Triticum sp.	.	.	.	.	.	.	.	.	.	.	.
Cereal	.	+	+	0.01	0.01	+	0.01	+	0.02	0.05	0.03
cf. *Prunus*/Rosac.	.	.	.	.	.	.	.	.	.	.	.
cf. *Vitis*	.	.	.	.	.	.	.	.	.	.	.
nutshell?	.	.	.	.	.	.	.	.	.	.	.
cf. pulse	.	.	.	.	.	.	.	.	.	.	.
<u>Wild & weedy</u>											
AN Apiaceae-1	.	.	.	.	1	.	.	.	.	.	.
cf. *Artemisia*	.	.	.	.	.	.	.	.	.	.	.
cf. *Taraxacum/Crepis*	.	.	.	.	.	.	.	.	.	.	.
AN Asteraceae-1	.	.	.	1	.	.	.	.	.	.	.
AN Asteraceae-2	.	.	.	.	.	.	.	.	.	1	2
Asteraceae indet.	.	.	.	.	.	.	.	.	.	.	1
Heliotropium-1	.	.	1	.	.	.	.	.	.	.	2
Heliotropium-2	.	.	.	.	.	.	.	.	.	.	.
cf. *Alyssum*	.	.	.	.	.	.	.	.	.	.	.
cf. *Neslia*	.	.	.	.	.	.	.	.	.	.	.
AN Brassicaceae-1	.	.	.	.	.	.	.	.	.	.	.
Brassicaceae indet.	.	.	.	.	.	.	.	.	.	.	.
Capparis	.	.	.	.	.	.	.	.	.	.	.
AN Caryophyllaceae-1	.	.	.	.	.	.	.	.	.	1	.
cf. *Chenopodium*	.	.	.	.	.	.	.	.	.	.	.
cf. *Salsola*	.	.	.	5	4	.	.	.	.	1	4
cf. *Suaeda*	.	.	1	1	.	.	.	.	.	.	.
Chenopodiaceae	.	.	.	.	.	.	.	.	.	.	.
cf. *Carex*	.	.	.	1	.	.	.	.	.	.	.
cf. *Scirpus*	.	.	.	1	.	.	.	.	.	.	.
AN Cyperaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Cyperaceae-2	.	.	.	.	.	.	.	.	.	1	.
Cyperaceae/*Polygonum*	.	.	.	.	.	.	.	.	.	.	.
Cyperaceae indet.	.	.	.	.	2	.	.	.	.	.	.
cf. *Alhagi*	.	.	.	2	.	.	.	.	.	.	.
Astragalus	.	.	.	.	.	.	.	.	1	.	.
Trifolium/Melilotus	.	.	.	.	.	.	.	.	.	1	.
Trigonella	.	1	.	2	2	.	2	.	.	6	11
AN Fabaceae-1	.	.	.	.	.	.	.	.	3	.	.
Fabaceae indet.	.	2	1	.	.	.	.	.	1	.	2
cf. *Ziziphora*	.	.	.	.	.	.	.	.	.	.	.
AN Lamiaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Lamiaceae-2	.	.	.	.	.	.	.	.	.	1	.
AN Lamiaceae-3	.	.	.	.	.	.	.	.	.	.	.
Lamiaceae indet.	.	.	.	.	.	.	.	.	.	.	.
AN cf. Liliaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Liliaceae-2	.	.	.	.	.	.	.	.	.	.	.
Aegilops	.	.	.	.	.	.	.	.	.	.	2
cf. *Bromus*	.	.	.	.	.	.	.	.	.	.	.
Eremopyrum	.	.	.	.	.	.	.	.	.	.	.
Hordeum murinum-type	.	.	.	.	.	.	.	.	.	.	.
Phleum/Eragrostis	.	.	.	.	.	.	.	.	.	1	1
cf. *Setaria*	.	.	.	.	.	.	.	.	.	.	1
AN Poaceae-1	.	3	1	37	.	2	.	.	1	29	37
AN Poaceae-2	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-3	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-4	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-5	.	.	.	1	.	.	.	.	.	.	.
AN Poaceae-6	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-7	.	.	.	.	.	.	.	.	.	.	1
Poaceae indet.	.	.	.	1	1	.	.	.	2	7	.
Fumaria	.	.	.	.	.	.	.	.	.	.	.
cf. *Portulaca*	.	.	.	.	.	.	.	.	.	.	.
Androsace	.	.	.	.	.	.	.	.	.	.	.
Adonis	.	.	.	.	.	.	.	.	.	.	.
Ceratocephalus	.	.	.	.	.	.	.	.	.	.	.
Galium	.	.	.	1	.	.	.	.	.	.	.
AN unknown-1	.	.	.	.	.	.	.	.	.	.	.
AN unknown-2	.	.	.	.	.	.	.	.	.	.	.
AN unknown-3	.	.	.	.	.	.	.	.	.	.	.
AN unknown-5	.	.	.	.	1	.	.	.	.	.	.
AN unknown-8	.	.	.	.	.	.	.	.	.	.	.
unknown	.	.	.	4	.	.	.	.	.	9	.
<u>Plant parts</u>											
Asteraceae capitulum	.	.	.	.	.	.	.	.	.	.	.
Euclidium	.	1	.	.	.	.	.	.	.	4	2
silique frag, AN Brassicaceae-1	.	.	.	.	.	.	.	.	.	.	.
Atriplex fruit	.	.	.	.	.	.	.	.	.	.	.
Alhagi pod segment	.	.	.	.	.	.	.	.	4	.	.
Hordeum vulgare var. *hexastichum* internode	.	1	.	.	.	5	.	.	2	45	5
Hordeum vulgare internode	.	.	.	.	.	1	1	.	.	10	4
Triticum internode	.	.	.	.	.	3	.	1	.	33	.
Aegilops glume base	.	.	.	.	.	.	.	.	.	2	1
Poaceae culm node	.	.	.	.	.	3	.	.	1	1	.
cf. *Phragmites* culm node	.	.	.	.	.	.	2	.	.	.	.
unknown	.	.	.	.	.	1	.	.	.	.	.
<u>Uncharred</u>											
Celtis	.	.	+	3	0.5	.	.	.	.	.	5
Lithospermum	.	.	.	.	1	.	.	.	.	.	.
mineralized seed	.	1	.	.	.	.	.	.	.	.	.

Table C.2, cont.

Layer Section Locus Sample no.	14 AN.M 3 97.035	14 AN.M 6 97.036	14 AN.M 7 97.037	14 AN.M 9 97.040	14 AN.M 11 97.045	16 AN.N 5.14.29 97.082	17-lower AN.N 5.14.28 97.081	18 AN.N 5.13.23 97.078	18 AN.N 5.13.24 97.077	19 AN.N 5.12.10 97.063	19 AN.N 5.12.13 97.067
volume (l)	12	8	5	2.7	8	8	8	5	4	1	4
charcoal (>2mm; g)	8.68	3.50	17.71	13.48	0.22	12.79	5.07	11.13	33.11	0.65	25.96
seed (>2mm; g)	0.04	0.05	0.03	.	0.06	0.04	0.02	2.51	+	0.12	0.16
misc (>2mm; g)	+	0.04	0.01	.	+	+	0.05	0.02	.	0.06	+
wild & weedy (#)	60	8	9	10	38	2	2	2399	1	158	16
density	0.73	0.45	3.55	4.99	0.04	1.60	0.64	2.73	8.28	0.83	6.53
seed/charcoal	0.005	0.014	0.002	+	0.273	0.003	0.004	0.225	+	0.185	0.006
wild & weedy/charcoal	6.91	2.29	0.51	0.74	172.73	0.16	0.39	215.54	0.03	243.08	0.62
Food plants											
Hordeum	0.03	0.02	0.02	.	+	0.02	0.01	2.14	.	0.05	0.07
Triticum aestivum	+	.	.	.	.	.	.	0.10	.	.	.
Triticum sp.	.	.	.	.	0.03	.	.	.	.	.	.
Cereal	0.01	0.04	0.01	0.01	+	0.01	0.01	0.82	0.02	0.03	0.19
cf. *Prunus*/Rosac.	.	.	.	.	.	.	.	.	.	.	.
cf. *Vitis*	.	.	.	.	.	.	.	.	.	.	.
nutshell?	+	.	.	.	.	.	.	.	.	.	.
cf. pulse	.	.	.	.	+	.	.	.	.	.	.
Wild & weedy											
AN Apiaceae-1	.	.	.	.	1	.	.	.	.	.	.
cf. *Artemisia*	.	.	.	.	.	.	.	15	.	.	.
cf. *Taraxacum/Crepis*	.	.	.	.	.	.	.	.	.	.	.
AN Asteraceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Asteraceae-2	1	.	.	.	.	.	.	7	.	.	.
Asteraceae indet.	.	.	.	.	.	.	.	.	.	.	.
Heliotropium-1	1	.	.	.	9	.	1	5	.	1	1
Heliotropium-2	.	.	.	.	.	.	.	.	.	.	.
cf. *Alyssum*	.	.	.	.	.	.	.	1	.	.	.
cf. *Neslia*	.	.	.	.	.	.	.	.	.	.	.
AN Brassicaceae-1	.	.	.	.	.	.	.	14	.	.	.
Brassicaceae indet.	.	.	.	.	.	.	.	.	.	.	.
Capparis	.	.	.	.	.	.	.	35	.	.	.
AN Caryophyllaceae-1	.	.	.	.	.	.	.	.	.	.	.
cf. *Chenopodium*	.	.	.	.	.	.	.	.	.	.	.
cf. *Salsola*	.	.	2	10	.	.	.	3	.	.	.
cf. *Suaeda*	.	.	.	.	.	.	.	.	.	.	.
Chenopodiaceae	.	.	.	.	4	.	.	1	.	.	.
cf. *Carex*	.	.	.	.	.	.	.	.	.	1	.
cf. *Scirpus*	.	.	.	.	.	.	.	.	.	.	.
AN Cyperaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Cyperaceae-2	.	.	.	.	.	.	.	.	.	.	.
Cyperaceae/*Polygonum*	.	.	.	.	.	.	.	.	.	.	.
Cyperaceae indet.	.	.	.	.	1	.	.	.	.	.	.
cf. *Alhagi*	.	.	.	.	.	.	.	.	.	.	.
Astragalus	.	.	.	.	1	.	.	113	.	.	.
Trifolium/Melilotus	.	.	.	.	.	.	1	.	.	.	.
Trigonella	8	2	.	.	1	.	.	1438	.	.	5
AN Fabaceae-1	3	.	.	.	.	.	.	186	.	.	2
Fabaceae indet.	.	.	.	.	13	.	.	480	.	1	.
cf. *Ziziphora*	1	.	.	.	.	.	.	4	.	.	.
AN Lamiaceae-1	.	.	.	.	.	.	.	.	.	.	.
AN Lamiaceae-2	.	.	.	.	.	.	.	.	.	.	.
AN Lamiaceae-3	.	.	.	.	.	.	.	2	.	.	.
Lamiaceae indet.	.	.	.	.	.	.	.	.	.	.	.
AN cf. Liliaceae-1	.	.	.	.	1	.	.	.	.	.	.
AN Liliaceae-2	.	.	.	.	.	.	.	1	.	.	.
Aegilops	2	2	.	.	.	.	.	.	.	73	3
cf. *Bromus*	.	.	.	.	.	.	.	.	.	.	.
Eremopyrum	2	.	1	.	.	.	.	4	.	.	1
Hordeum murinum-type	.	.	.	.	.	.	.	4	.	2	.
Phleum/Eragrostis	.	.	.	.	.	.	.	3	.	.	.
cf. *Setaria*	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-1	36	.	2	.	4	.	.	30	.	.	.
AN Poaceae-2	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-3	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-4	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-5	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-6	.	.	.	.	.	.	.	.	.	.	.
AN Poaceae-7	.	.	.	.	.	.	.	.	.	.	.
Poaceae indet.	2	3	.	.	2	2	.	10	1	71	1
Fumaria	.	.	.	.	.	.	.	.	.	.	.
cf. *Portulaca*	.	.	.	.	.	.	.	.	.	.	.
Androsace	.	.	.	.	.	.	.	2	.	.	.
Adonis	1	.	.	.	.	.	.	.	.	.	.
Ceratocephalus	.	.	.	.	.	.	.	.	.	.	.
Galium	2	.	.	.	.	.	.	5	.	.	.
AN unknown-1	.	.	.	.	.	.	.	.	.	.	.
AN unknown-2	.	.	.	.	.	.	.	.	.	.	.
AN unknown-3	.	.	.	.	.	.	.	.	.	.	.
AN unknown-5	.	.	.	.	.	.	.	2	.	7	.
AN unknown-8	.	1	.	.	.	.	.	.	.	.	.
unknown	1	.	2	.	1	.	.	34	.	2	3
Plant parts											
Asteraceae capitulum	.	.	.	.	.	.	.	1	.	.	.
Euclidium	.	.	1	.	8	.	2	3	.	1	.
silique frag, AN Brassicaceae-1	.	.	.	1	.	.	.	.	.	.	.
Atriplex fruit	.	.	.	.	.	.	.	.	.	.	.
Alhagi pod segment	.	.	.	.	.	.	.	.	.	.	.
Hordeum vulgare var. *hexastichum* internode	3	4	.	.	.	4	1	5	.	53	.
Hordeum vulgare internode	4	4	.	3	1	.	.	6	.	35	1
Triticum internode	11	.	.	3	.	1	1	4	.	15	.
Aegilops glume base	1	1	.	.	1	.	.	.	.	36	3
Poaceae culm node	2	.	1	.	.	.	.	2	.	1	.
cf. *Phragmites* culm node	.	.	.	.	.	.	.	.	.	.	.
unknown	.	.	.	.	.	.	.	.	.	1	.
Uncharred											
Celtis	.	.	.	.	.	+	.	.	.	.	.
Lithospermum	.	.	7	.	.	.	.	.	.	.	.
mineralized seed	.	.	.	.	.	.	.	.	.	.	.

Table C.2, cont.

Layer	19	19	19	19	19-lower	20-upper	20	20	"sterile"
Section	AN.N	AN.N	AN.N	AN.N	AN.N	AN.N	AN.N	AN.N	AN.N
Locus	5.13.17	5.13.18	5.13.19	5.13.21	5.13.18	5.12.07	5.12.02	5.12.27	5.12.01
Sample no.	97.072	97.073	97.074	97.075	97.064	97.060	97.057	97.066	97.056
volume (l)	2	3	2	7	3	5	2	4	4
charcoal (>2mm; g)	0.24	14.56	27.58	32.67	14.32	15.98	27.17	25.13	4.85
seed (>2mm; g)	.	0.25	0.03	0.16	0.02	0.05	0.01	0.18	0.02
misc (>2mm; g)	.	0.02	0.03	0.02	0.03	0.04	.	0.02	.
wild & weedy (#)	.	134	6	107	95	167	45	253	.
density	0.12	4.94	13.82	4.69	4.79	3.21	13.59	6.33	1.22
seed/charcoal	.	0.017	0.001	0.005	0.001	0.003	+	0.007	0.004
wild & weedy/charcoal	.	9.20	0.22	3.28	6.63	10.45	1.66	10.07	.
Food plants									
Hordeum	.	0.13	0.03	0.08	0.01	0.03	.	0.07	0.01
Triticum aestivum	.	0.06	.	0.01	+	+	.	0.01	.
Triticum sp.	.	.	.	.	.	.	.	.	.
Cereal	.	0.08	.	0.06	0.01	0.02	+	0.05	+
cf. *Prunus*/Rosac.	.	.	.	.	.	.	.	.	.
cf. *Vitis*	.	.	.	.	.	.	.	.	.
nutshell?	.	.	.	.	.	.	.	.	.
cf. pulse	.	.	.	.	.	.	.	.	.
Wild & weedy									
AN Apiaceae-1	.	.	.	.	.	.	.	.	.
cf. *Artemisia*	.	.	.	2	.	.	1	.	.
cf. *Taraxacum/Crepis*	.	.	.	.	.	.	.	.	.
AN Asteraceae-1	.	.	.	.	.	.	.	.	.
AN Asteraceae-2	.	.	.	.	.	.	.	.	.
Asteraceae indet.	.	.	.	.	.	.	.	.	.
Heliotropium-1	.	2	1	6	4	33	3	48	.
Heliotropium-2	.	.	.	.	.	.	.	.	.
cf. *Alyssum*	.	.	.	.	.	.	.	.	.
cf. *Neslia*	.	.	.	.	.	.	.	.	.
AN Brassicaceae-1	.	.	.	.	.	.	.	.	.
Brassicaceae indet.	.	.	.	1	.	.	.	3	.
Capparis	.	13	1	.	1	.	.	.	.
AN Caryophyllaceae-1	.	2	.	.	.	4	10	1	.
cf. *Chenopodium*	.	.	.	.	.	.	.	.	.
cf. *Salsola*	.	4	1	.	.	1	3	.	.
cf. *Suaeda*	.	.	.	.	.	.	.	.	.
Chenopodiaceae	.	.	.	.	.	2	.	4	.
cf. *Carex*	.	.	.	.	.	3	.	.	.
cf. *Scirpus*	.	.	.	.	.	.	.	.	.
AN Cyperaceae-1	.	.	.	1	.	.	.	.	.
AN Cyperaceae-2	.	.	.	.	.	.	.	1	.
Cyperaceae/*Polygonum*	.	5	.	1	.	.	.	.	.
Cyperaceae indet.	.	.	.	.	.	.	.	.	.
cf. *Alhagi*	.	.	.	.	.	.	.	.	.
Astragalus	.	.	.	1	1	.	.	.	.
Trifolium/Melilotus	.	.	.	.	.	.	.	113	.
Trigonella	.	29	1	37	74	12	5	22	.
AN Fabaceae-1	.	.	.	.	.	.	.	.	.
Fabaceae indet.	.	8	.	6	5	67	.	2	.
cf. *Ziziphora*	.	.	.	.	.	.	.	.	.
AN Lamiaceae-1	.	.	.	.	.	.	.	.	.
AN Lamiaceae-2	.	1	.	.	.	.	.	.	.
AN Lamiaceae-3	.	.	.	.	.	.	.	.	.
Lamiaceae indet.	.	.	.	.	1	.	.	.	.
AN cf. Liliaceae-1	.	.	.	.	.	.	.	.	.
AN Liliaceae-2	.	.	.	.	.	.	.	.	.
Aegilops	.	4	.	5	.	5	1	5	.
cf. *Bromus*	.	.	.	.	.	.	.	.	.
Eremopyrum	.	.	.	.	.	.	.	.	.
Hordeum murinum-type	.	1	.	.	.	1	.	2	.
Phleum/Eragrostis	.	.	.	1	.	.	.	.	.
cf. *Setaria*	.	.	.	.	.	.	.	.	.
AN Poaceae-1	.	12	.	9	.	.	1	.	.
AN Poaceae-2	.	.	.	.	.	.	.	.	.
AN Poaceae-3	.	.	.	.	.	.	.	.	.
AN Poaceae-4	.	.	.	.	.	.	.	.	.
AN Poaceae-5	.	.	.	.	.	.	.	.	.
AN Poaceae-6	.	.	.	.	.	.	.	.	.
AN Poaceae-7	.	.	.	.	.	.	.	.	.
Poaceae indet.	.	6	1	16	4	12	1	15	.
Fumaria	.	.	.	.	.	.	.	.	.
cf. *Portulaca*	.	.	.	.	.	1	.	.	.
Androsace	.	.	.	.	.	.	.	.	.
Adonis	.	1	.	2	1	1	3	2	.
Ceratocephalus	.	.	.	.	.	.	1	.	.
Galium	.	2	.	2	.	1	.	.	.
AN unknown-1	.	.	.	.	.	.	.	.	.
AN unknown-2	.	.	.	.	.	.	.	.	.
AN unknown-3	.	.	.	.	.	.	.	.	.
AN unknown-5	.	4	1	2	.	.	.	1	.
AN unknown-8	.	.	.	.	.	.	.	.	.
unknown	.	40	.	15	4	24	16	34	.
Plant parts									
Asteraceae capitulum	.	.	.	.	.	.	.	.	.
Euclidium	.	8	1	3	1	14	.	5	.
silique frag, AN Brassicaceae-1	.	.	.	.	.	.	.	.	.
Atriplex fruit	.	2	.	.	.	.	.	.	.
Alhagi pod segment	.	1	.	.	.	.	.	.	.
Hordeum vulgare var. *hexastichum* internode	.	5	3	21	4	14	1	17	.
Hordeum vulgare internode	.	.	1	6	.	8	.	2	.
Triticum internode	.	.	.	4	.	6	.	11	.
Aegilops glume base	.	2	.	4	5	3	.	8	.
Poaceae culm node	.	.	2	.	.	2	.	.	.
Cf. *Phragmites* culm node	.	.	.	.	.	.	.	.	.
unknown	.	.	.	.	2	.	.	.	.
Uncharred									
Celtis	2.5	.	5	0.5	.	0.5	.	.	.
Lithospermum	.	.	.	1	.	.	.	.	.
mineralized seed	.	.	.	.	.	.	.	.	.

Table C.3 Charcoal from Anau North Flotation Samples (weight, g)

Layer/Context		Sample 97.	tot. wt.	wt. a'lyzed	Juniperus	conifer	"saksaul"	"sazak"	Fraxinus	Populus Salix	Tamarix	cf. Tamarix	unknown
3	ANI 11	002	15.06	0.34	.	.	.	.	.	.	.	0.34	.
3	ANI 13	005	21.18	1.91	.	.	.	.	.	.	1.91	.	.
3	ANI 13	006	16.92	3.06	0.53	.	.	.	.	0.59	1.94	.	.
3	ANI 9	031	8.69	1.25	.	.	.	.	.	.	0.32	0.93	.
8	ANL 4	028	15.43	1.39	.	.	.	.	.	.	0.50	0.89	.
8	ANL 4	029	8.94	0.12	.	.	.	.	.	.	0.12	.	.
9	ANN 32	085	38.96	10.62	.	0.37	.	.	.	5.49	4.76	.	.
11	ANN 31	084	30.47	1.82	.	.	0.27	.	.	.	1.03	0.52	.
12	ANN 30	083	26.33	1.91	.	.	0.09	0.02	.	.	1.80	.	.
14	ANM 2	032	6.62	0.85	0.09	.	.	.	.	.	0.44	0.13	0.19
14	ANM 3	034	12.36	1.39	.	.	.	.	.	0.08	.	1.31	.
14	ANM 3	035	8.68	1.50	.	.	.	.	.	0.32	1.08	0.10	.
14	ANM 7	037	17.71	0.63	.	.	0.14	.	.	.	0.49	.	.
14	ANM 9	040	13.48	0.91	.	.	.	0.07	.	.	0.84	.	.
16	ANN 29	082	12.79	1.30	.	.	0.50	.	.	.	0.41	0.23	0.16
18	ANN 24	077	33.11	3.24	.	.	.	.	.	.	2.87	0.37	.
18	ANN 23	078	11.13	0.19	.	.	.	.	.	.	0.19	.	.
19	ANN 13	067	25.96	0.65	.	.	.	.	.	.	0.12	0.11	0.42
19	ANN 18	073	14.56	0.94	.	.	.	.	.	.	0.86	0.08	.
19	ANN 19	074	27.58	4.79	.	.	.	.	.	.	4.06	0.73	.
19	ANN 21	075	32.67	1.72	.	.	.	.	.	.	1.72	.	.
19	ANN 18	064	14.32	0.79	.	.	0.05	.	.	.	0.09	0.54	0.11
20	ANN 7	060	15.98	2.11	.	.	.	.	.	0.37	1.33	0.41	.
20	ANN 2	057	27.17	3.72	.	.	.	.	.	.	3.09	0.63	.
20	ANN 27	066	25.13	3.42	.	.	.	.	.	.	2.68	0.74	.
20	ANN 1	056	4.85	1.45	.	.	.	.	0.24	.	0.74	0.26	0.21

Table C.4 Charcoal from Anau North Flotation Samples (count)

Layer/Context		Sample 97.	no. a'lyzed	Juniperus	conifer	"saksaul"	"sazak"	Fraxinus	Populus Salix	Tamarix	cf. Tamarix	unknown
3	ANI 11	002	1	.	.	.	.	.	.	.	1	.
3	ANI 13	005	2	.	.	.	.	.	.	2	.	.
3	ANI 13	006	10	2	.	.	.	.	2	6	.	.
3	ANI 9	031	7	.	.	.	.	.	.	2	5	.
8	ANL 4	028	5	.	.	.	.	.	.	1	4	.
8	ANL 4	029	1	.	.	.	.	.	.	1	.	.
9	ANN 32	085	10	.	1	.	.	.	5	4	.	.
11	ANN 31	084	10	.	.	1	.	.	.	6	3	.
12	ANN 30	083	10	.	.	1	1	.	.	8	.	.
14	ANM 2	032	4	1	.	.	.	.	.	1	1	1
14	ANM 3	034	5	.	.	.	.	.	1	.	4	.
14	ANM 3	035	7	.	.	.	.	.	2	4	1	.
14	ANM 7	037	7	.	.	2	.	.	.	5	.	.
14	ANM 9	040	4	.	.	.	1	.	.	3	.	.
16	ANN 29	082	8	.	.	2	.	.	.	3	2	1
18	ANN 24	077	5	.	.	.	.	.	.	4	1	.
18	ANN 23	078	1	.	.	.	.	.	.	1	.	.
19	ANN 13	067	4	.	.	.	.	.	.	1	1	2
19	ANN 18	073	6	.	.	.	.	.	.	5	1	.
19	ANN 19	074	10	.	.	.	.	.	.	9	1	.
19	ANN 21	075	5	.	.	.	.	.	.	5	.	.
19	ANN 18	064	8	.	.	1	.	.	.	1	4	2
20	ANN 7	060	10	.	.	.	.	.	2	6	2	.
20	ANN 2	057	9	.	.	.	.	.	.	7	2	.
20	ANN 27	066	9	.	.	.	.	.	.	7	2	.
20	ANN 1	056	10	.	.	.	.	2	.	5	2	1

Table C.5 Summary of Anau North Flotation Samples

	Anau II layer 3	Anau IB layers 5-18	Anau IA layers 19-20
number of samples	5	11	26
total volume floated (liters)	38	197	37
total charcoal (>2 mm; g)	62.92	273.72	189.11
total seed (>2 mm; g)	0.25	3.30	1.00
total miscellaneous (>2 mm; g)	0.01	2.69	0.22
total wild & weedy (no.)	369	2940	981
average density (g/liter)	2.18	2.04	5.46
average seed/charcoal (g/g)	+	0.03	0.02
average wild & weedy/charcoal (no./g)	8	18	26

Table C.6 Summary of Plant Names, Characteristics

	form	life cycle	common name; other notes
Apiaceae	h		Queen Anne's lace family
Asteraceae			daisy, thistle family (Compositae)
cf. *Artemisia*	ss (h)	p (a)	wormwood
cf. *Taraxacum/Crepis*	h	p/p,a	dandelion/
Boraginaceae			borage family
Heliotropium	h	a, p	
Brassicaceae			mustard family (Cruciferae)
cf. *Alyssum*	h	a, p	
Euclidium syriacum	h	a	
cf. *Neslia*	h	a	
Capparidaceae			caper family
Capparis	s	p	caper
Caryophyllaceae	h		pink family
Chenopodiaceae			goosefoot family
Atriplex	h (s)	a (p)	
cf. *Chenopodium*	h	a, p	goosefoot
Haloxylon	s	p	saksaul
cf. *Salsola*	h, ss	a, p	grows in salty places
cf. *Suaeda*	h. s	a, p	grows in sandy, salty places
Cupressaceae			
Juniperus	t	p	juniper
Cyperaceae	h		sedge family
cf. *Carex*	h	p	grows in moist habitat
cf. *Scirpus*	h	p	grows in moist habitat
Fabaceae			pea/legume family (Leguminosae)
Alhagi	ss	p	camelthorn
Astragalus	s, h	a, p	
Trifolium/Melilotus	h	a	clover/melilot
Trigonella	h	a	trigonel
Lamiaceae			mint family (Labiatae)
cf. *Ziziphora*	h	a, p	
Pinaceae			
cf. *Pinus*	t	p	pine
Poaceae	h		grass family (Gramineae)
Aegilops	h	a	goat-face grass
cf. *Bromus*	h	a	brome
Phleum/Eragrostis	h	a	
Eremopyrum	h	a	
Hordeum murinum-type	h	a	wild barley
Hordeum vulgare var. *hexastichum*	h	a	6-row barley, cultivated
cf. *Setaria*	h	a	
Triticum aestivum	h	a	bread wheat, cultivated
Fumaricaceae			
Fumaria	h	a	fumitory
Portulacaceae			
cf. *Portulaca*	h	a	purslane; potherb
Primulaceae			
Androsace	h	a, p	
Ranunculaceae			buttercup family
Adonis	h	a, p	
Ceratocephalus	h	a	
Rubiaceae			bedstraw family
Galium	ss	a, p	bedstraw
Salicaceae			
Salix/Populus	t	p	willow/poplar, grows along watercourses
Tamaricaceae			
Tamarix	t	p	tamarisk, grows along watercourses, swales

form: h=herb, ss=small shrub, s=shrub, t=tree
life cycle: a=annual, p=perennial
parentheses indicate possible for the taxon, but less likely here

Table C.7 Barley Measurements from AN97.078 (Layer 18)

N=64	Length (mm)	Breadth (mm)	Thickness (mm)	L:B	T:B
min.	3.3	1.7	1.1	1.25	0.52
mean	4.2	2.7	2.1	1.59	0.75
max.	5.0	3.9	2.8	2.50	0.89
S.D.	0.50	0.55	0.48	0.28	0.07

Table C.8 Length:Breadth Ratios of Six-row Barley from Other Sites

	N (grains)	L:B	range
Anatolian plateau			
Erbaba (naked)	28	1.89	1.65-2.32
	100	1.78	1.50-2.17
	44	1.88	1.48-2.17
Mesopotamia			
Yarym-Tepe I (naked)	-	1.66	-
	-	1.30	-
	-	1.74	-
	-	1.37	-
Yarym-Tepe I (hulled)	-	2.14	-
	-	1.83	-
	-	2.27	-
	-	1.90	-
Yarym-Tepe II (naked)	-	1.97	-
	-	2.06	-
Yarym-Tepe II (hulled)	-	1.96	-
	-	1.79	-
	-	1.96	-
	-	1.96	-
Karana 3†	25	2.08	1.89-2.41
	5	1.97	1.78-2.15
	20	2.19	1.55-2.65
'Oueili (hulled)	50	1.73	1.53-2.06
Tell Madhhur	20	2.07	1.71-2.60
Ur (hulled)	10	2.06	1.79-2.48
Iranian plateau			
Gijlar (naked)	-	1.59	-
Hissar (naked)	10	1.68	1.58-1.94
	10	1.58	1.36-1.98
Pakistan			
Loebanr- 3 (Swat) (naked)	2	1.55	1.54-1.55

- : not reported
† : probably a contaminant in emmer crop; hulled?

Erbaba (van Zeist and Buitenhuis 1983), el 'Oueli (Neef 1991), Madhhur (Renfrew 1984), Ur (Ellison et al. 1978), Karana 3 (Costantini and Costantini Biasini 1993), Loebanr- 3 (Costantini 1987), Yarym-Tepe I

Table C.9 Fragments of Charred Animal Dung and Sheep/Goat Pellets larger than 2 mm

sample	provenience	level	amount, g	
97.002	ANI 11	3	0.01	
97.005	ANI 13	3	0.01	
97.006	ANI 13	5	0.02	
97.013	ANJ 6	5	0.76	1 whole (0.10 g) and fragments (0.66 g)
97.029	ANL 4	8	0.03	
97.031	ANI 9	3		[unmeasureable, but floating soil clumps looked dung-like]
97.032	ANM 2	14	0.21	1 whole (0.13 g) and fragments (0.08 g); also 2 whole, unburnt (0.32 g)
97.045	ANM 11	14		[laminar structure of soil clumps looked like stable litter]
97.078	ANN 23	18	3.43	3 whole (0.30 g) and fragments (3.13 g); one fragment with a seed embedded
97.073	ANN 18	19	1.37	[probably dung]
97.075	ANN 21	19	0.39	
97.064	ANN 18	19	0.12	
97.060	ANN 7	20	0.19	sheep goat pellet fragments (0.07 g), other fragments (0.12 g)
97.057	ANN 2	20	0.05	
97.066	ANN 27	20	0.30	also, uncharred sheep goat dung: 1 whole (0.04 g) and fragments (0.44 g)