1996

Appendix C: Palaeoethnobotany

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Recommended Citation (OVERRIDE)

Miller, N. F. (1996). Appendix C: Palaeoethnobotany. In E. Carter (Ed.), *Excavations at Anshan (Tal-E Malyan): The MIddle Elamite Period* (pp. 99-108). University Museum Monograph 82. Philadelphia, PA: The University Museum of Archaeology and Anthropology, University of Pennsylvania.

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Disciplines
Archaeological Anthropology | Biological and Physical Anthropology

University Museum Monograph 82

MALYAN EXCAVATION REPORTS
William M. Sumner, Series Editor
VOLUME II

EXCAVATIONS AT ANSHAN (TAL-E MALYAN): THE MIDDLE ELAMITE PERIOD

Elizabeth Carter

With contributions by:

Ken Deaver (Chipped stone)
Naomi Miller (Paleoethnobotany)
Chandra Reedy (Optical mineralogy)
Architectural Drawings and Reconstructions by W. Patrick Finnerty and Elizabeth Carter

Published by

THE UNIVERSITY MUSEUM
of Archaeology and Anthropology
University of Pennsylvania
Philadelphia
1996

Appendix C

Palaeoethnobotany

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Archaeobotanical samples from the 1974 and 1976 excavations of area EDD at Malyan were submitted for identification and analysis.[1] Nearly all the samples come from the main Middle Elamite structure, a large public building that was destroyed by fire in antiquity. Sediment samples were taken for flotation, and large pieces of charcoal were sometimes taken as miscellaneous samples.

Flotation

Flotation samples were taken from several rooms and other features, but not all features were examined (Appendix C, Tables 1 and 2). The research was carried out early in the author's career, and certain procedures for extracting and recording samples were changed as experience dictated. This circumstance diminishes the comparability of samples taken in 1974 and 1976, but I hope that the following report will not suffer excessively.

During both seasons, a manual flotation system was used. Small amounts of sediment were poured into a sieve (in 1974, c. 1.5 mm mesh) or soup strainer (in 1976, c. 1 mm mesh), which was then placed in water. After gentle agitation, floating material was scooped up with a tea strainer of smaller mesh. The residue was examined by eye, and the procedure was repeated until no charred material remained in the large strainer. The charred material was set in cloth to dry and then be transferred to permanent containers.

In 1974, samples were not sieved prior to flotation, and the weight of the sediment samples was recorded. Beginning in 1976, the volume of excavated, sieved sediment was measured in buckets of known volume. Usually, the sieve used had a 1-cm mesh. A few samples from areas in which tablets had been found were sieved with a smaller mesh (0.25 cm). After the 1974 season, several 10-liter buckets of sediment were weighed in order to get an approximate conversion from weight to volume to facilitate

1. This report is one part of a larger study of the plant remains from Malyan. Analysis of the late fourth to early second millennium remains is available elsewhere (Miller 1982, 1985). I refer the reader to these publications for a fuller account of the earlier periods to which occasional reference has been made.

comparisons between samples. The sediment weight was about 10 to 15 kg per bucket, depending on the type of sediment, and I have converted the sample weight to approximate volume using 12 kg/10 liters for this report.

Laboratory procedures were also not completely uniform. Ordinarily, the processed samples were put through a 0.85-mm geological sieve. Material smaller than 0.85 mm was examined only for seeds and other identifiable material. Material larger than 0.85 mm was sorted completely. Occasionally, a sample was so large that total sorting was not possible. In that case, a portion was sorted completely, and the remainder was examined for seeds. Proportions and densities of charred material were then estimated. Samples with large quantities of reeds could not be sorted completely, either, so estimates of the relative quantities of charcoal, reeds, and seeds were made. For these reasons, the quantitative information in the accompanying tables provides only a rough idea of the quantities of material recovered.

Most charcoal pieces recovered by flotation are quite small, less than 2 mm on a side. An attempt was made to identify up to 20 pieces per sample where possible (Appendix C, Table 3). Pieces weighing less than 0.01 g were considered too small to identify. Charcoal and seeds were examined with a binocular microscope (7–30x). Identifications are based on comparative material in the author's collection of modern seeds and wood, a duplicate set of which is located in the University of Michigan Museum of Anthropology Ethnobotanical Laboratory, Ann Arbor. For some taxa, it was possible to use published seed and wood manuals for other parts of the world. The laboratory work was largely completed by 1976, under the direction of R.I. Ford of the University of Michigan and W. van Zeist of the Biologisch-Archaeologisch Instituut.

Hand-picked Charcoal

Given the massive burning of many deposits, it was not possible to collect or identify all charcoal from area EDD. The excavator therefore chose a few pieces for the ethnobotanist to identify (Appendix C, Table 4). Most of the wood charcoal probably comes from roof beams. However, beams were rarely found in place. Unless different species are identified, it is not possible to know if a sample consisting of several pieces represents one original piece of wood or several. Therefore, only limited quantification of the wood charcoal is provided, as greater precision would be meaningless.

The Plants

Cereals (Gramineae)

Most of the cereal remains were severely fragmented and exploded, presumably owing to the intense burning of the building. Most were not identifiable even to the genus level, but are likely to be barley (*Hordeum* sp.) and wheat (*Triticum* sp.). Most of the identifiable grain is barley. At least some of the barley is the six-row type, *Hordeum vulgare,* since six twisted grains were noted.

Pulses (Leguminosae)

Less common than cereal, lentil occurs in small numbers. There were only two measurable lentils. Both are small (diameter 2.5 mm and 2.8 mm), similar to the lentils of the earlier periods at Malyan. The other cultivated legume is tentatively identified as bitter vetch (*Vicia ervilia*), a fodder plant.

Fruits

A few grape seeds (*Vitis vinifera*) and fragments of a hackberry (*Celtis*) seed were recovered. Grape was cultivated in the Kur basin from at least Banesh times. Hackberry is a member of the elm family with a tiny, but edible fruit. It occurs in such small quantities that it is impossible to determine whether it was collected for food. Since hackberry is the major tree of the Ulmaceae in this part of Iran, the occasional charcoal piece identified to that family is probably hackberry.

Nuts

Nutshell of pistachio (*Pistacia*) and almond (*Amygdalus scoparia* and *Amygdalus* sp.) occurs. All three are components of the pistachio-almond forest region of the southern Zagros. Both pistachio and almond are edible, although wild almond has a bitter aftertaste. Pistachio and almond charcoal do not occur in EDD; perhaps these trees were rare during Middle Elamite times, or were protected for nut production. The indeterminate nutshell category is a smooth-shelled type, presumably *Pistacia* or *A. scoparia.*

Wild and Weedy Plants

I assign seeds in this category to probable ecological group based on extensive botanizing in the Kur basin. "Weed" is a catch-all category for the herbaceous plants that are widespread in a variety of disturbed habitats. Although many species of weeds can be assigned to a more precise habitat, most of the archaeological specimens can be identified only by genus. The plants in the "weed" category include *Vaccaria, Centaurea, Astragalus, Adonis* cf. *dentata, Galium,* and various indeterminate Cruciferae, Gramineae, and Leguminosae. *Aegilops* is the only Middle Elamite weed restricted to dry-farmed areas in the Kur basin today, so it is accorded its own column. A few types (see chart) are found only in irrigated fields, including *Medicago, Malva, Fumaria,* and an indeterminate Boraginaceae. A fourth category ("Wet Area") comprises plants of very moist areas (streamsides, marsh, and heavily irrigated alfalfa and sugar beet fields). It includes *Setaria,* a grass, and *Carex,* a sedge. The taxa from which the weed seeds come can all be seen today in the Kur basin.

Other Woody Plants

In addition to the hackberry mentioned above, other woody plants are a source of charcoal in EDD. Poplar *(Populus)* and willow *(Salix),* fast-growing trees of streamsides and irrigated gardens, are used today for roof beams. This was undoubtedly true in the past as well. They could have occurred naturally or been planted. Poplar and willow can only be distinguished under high magnification, so the larger chunks of poplar were examined with an incident light mineralogical microscope at about 100x. Since the economic and ecological interpretations of poplar and willow are so similar, the flotation charcoal was not examined under high power. Ash (*Fraxinus*) is another moisture-loving tree that may be used for a variety of purposes (construction, fuel, tools, etc.). Oak (*Quercus aegilops*) is the dominant tree of the forest to the north and west of Malyan. Almond and pistachio are the two dominant genera of the woodland at the southeastern end of the Kur basin, but are not present as charcoal in the EDD samples. Maple (*Acer monspessulanum*) and juniper (*Juniperus*) could represent components of either woodland type.

Reeds

Unidentifiable slivers of charred reeds or grasses are common in samples at EDD.[2] Although some *Phragmites* stems have been seen in charcoal samples, most reeds come from flotation samples. Modern construction techniques provide a very obvious and plausible ethnographic analogy for the ancient situation. Straw matting is placed over wooden beams (typically poplar and willow today), and a layer of brush (willow branches and licorice [*Glycyrrhiza glabra*] are commonly used today) is placed on the mats. The roof is then topped with packed mud. Reeds are more common in some samples than others, presumably those which contain the remains of mats. Although they were sometimes seen to disintegrate during flotation, samples containing significant quantities of reeds are readily recognized.

The Deposits

The Middle Elamite material at Malyan comes from a large burned structure. Plant remains from Middle Elamite EDD are therefore not comparable to those of the earlier deposits represented at Malyan, which originated primarily in fuel, both wood and dung. The range of types represented is much more limited in EDD than in the earlier deposits, most probably a result of the very different circumstances of preservation. Major differences between the Banesh and Kaftari period assemblages, attributable to deforestation, are documented (Miller 1982, 1985), but differences between Kaftari and Middle Elamite assemblages are more readily explained by the unique character of the later deposit.

Ordinarily, the major source of charred material on an archaeological site is fuel, supplemented by the debris of refuse disposal and accidental burning. These items could account for some of the EDD remains. The charcoal could also be the remains of building furnishings (shelves, furniture, storage boxes). Seeds could come from stored materials (such as foodstuffs) and a variety of accidentally burned items. Most of the material at EDD is, however, probably from construction materials.

In order to identify some of the different sources of plant materials in EDD, it is useful to look at some of the basic characteristics of the samples. For example, samples with high concentrations of building debris are expected to contain much charcoal and reeds. In EDD, deposits with a high density of charred material have these high proportions of charcoal and reeds. In contrast, those deposits with relatively high proportions of seeds (more than 10% by weight) tend to have lower densities of charred material, generally under 1 g/10 l. sediment (Appendix C, Table 5). This group of samples is more typical of "ordinary" debris samples. The percentage of seeds by weight in these samples is similar to many Kaftari deposits, where dung fuel is thought to be a major source of charred plant material. One exception to this pattern is CRDX 60, where a relatively high proportion of charcoal and reeds is associated with a relatively high density of grain. This is a possible concentration of grain that is neither construction nor fuel. CRDX 15 also has a high grain density, though the proportion of seeds relative to charred material is fairly low (Appendix C, Table 6).

The contents of a group of jars from ROOM 69 were examined. It is clear that they contain burned construction debris; there is, however, no trace of the original contents.

2. It is not known whether the ancient matting from EDD was made of reeds (a category that includes the grass, *Phragmites*) or straw from the cultivated grasses, wheat and barley. Reeds could have grown wild on the meadow in the middle of the Beiza plain, about 2 km from Malyan, or along irrigation ditches. Straw would have been readily available as a by-product of cereal production.

Charcoal Analysis

Charcoal analysis of the earlier material from Malyan suggested a trend to deforestation between the Banesh and Kaftari periods (Miller 1985). Once set in motion, certain trends may become irreversible, such as increased erosion and destruction of seed sources. It is, however, possible for forests to recover even from severe human abuse, although fuel cutting and grazing will affect the speed with which this may occur.

People tend to collect fuel wood close to where they will use it, to limit transport costs. For that reason, charcoal analysis of fuel frequently provides a fair first approximation of the arboreal vegetation near a site. Applying this assumption, it was thought that juniper and (probably uncultivated) poplar grew near Malyan in the Banesh period. By Kaftari times, these fuels had declined in importance, and were replaced by the more distant oak. Other genera, such as maple, pistachio, and almond, did not show such clear-cut changes. If population declined in Middle Elamite times, and human disturbance was proportionately reduced, there could have been some forest regeneration. However, interpretation of the Middle Elamite situation is complicated by the unusual circumstances of preservation at EDD. In Middle Elamite times, the ubiquity of poplar at EDD attests to its use in construction (Appendix C, Table 7). It is possible that over the millennia, it had become primarily a cultivated tree, as it is today. Several chunks of maple charcoal are now thought to represent lumber as well, based on their archaeological context; the arrangement of maple charcoal visible in the baulk of DD 41, ROOM 76 suggests logs of maple were used for shelving (see above, p. 9).

Discussion

EDD plant remains largely originated in construction debris. Satisfying environmental and economic reconstructions are not possible with the available data. Two points of interest may, however, be noted. First, the apparent use of maple for shelving in the EDD structure suggests less degraded woodland conditions than today, where full-sized maple trees are not common in the Kur basin.

Second, the crop and weed seed assemblage contains only taxa known from the earlier periods at the site. However, the small numbers recovered preclude any precise statement about change or stability in agricultural practices between Kaftari and Middle Elamite times.

APPENDIX C, TABLE 1. Catalog of Flotation Samples[1]

BL	Feature	Square	Lot	DC	Volume (bucket)	Charcoal (g)	Reed (g)	Seed (g)	Charred dens. g/bucket	Seed Prop.	Comments
IVB	ROOM 151.2	FF41	73	26	1	0.49	-	0.01	0.50	0.02	
IVB	ROOM 154.2	FF41	78	26	1	0.36	-	-	0.36	-	
IVA	ROOM 5	CC43	25	26	2.8	62.64	47.79	0.02	39.44	+	34 kg (3); (4)
IVA	CRDX 15	DD45	13	26	1	56.65	0.51	1.34	60.44	0.02	12 kg (3); (4)
IVA	COUR 45.1	DD43	66, 67	35, 23	2	0.05	-	-	0.02	-	
IVA	COUR 45.2	DD43	69	26	1	0.40	0.14	0.97	1.51	0.64	(4)
IVA	COUR 45.3	EE45	30a	21	?	0.77	-	0.02	?	0.03	(2)
IVA	COUR 45.4	EE45	30b	21	?	0.62	-	0.22	?	0.26	
IVA	DOOR 59.1	DD43	43	26	1	11.41	-	0.21	11.62	0.02	12 kg (3)
IVA	DOOR 59.2	DD43	20	35	0.75	0.06	-	-	0.08	-	9 kg (3)
IVA	CRDX 60	DD41	61	26	1.25	5.45	2.33	3.51	9.03	0.31	15 kg (3)
IVA	ROOM 69.1	DD41	37	27	1	8.32	0.79	-	9.11	-	11 kg (3)
IVA	ROOM 69.2	DD41	47	26	0.25	10.49	1.01	0.01	46.00	+	3 kg (3); (4)
IVA	ROOM 69.3	DD41	49	26	1	0.85	1.22	0.01	2.08	+	11 kg (3)
IVA	CRDX 95	EE43	26	26	1	2.25	0.75	0.07	3.07	0.02	(4)
IVA	ROOM 96	FF41	37	35	0.5	0.17	-	+	0.34	+	
IVA	CRDX 139.1	EE45	28	25	1	0.23	-	0.01	0.24	0.04	
IVA	CRDX 139.2	EE45	32	26	0.7	2.84	-	0.01	4.07	+	
IVA	DOOR 140	EE45	33	21	1	0.25	-	0.07	0.32	0.22	
IVA	DOOR 141	EE45	31	26	1	2.57	-	0.03	2.60	0.01	
IVA	DOOR 142	EE45	36	26	0.5	6.79	-	+	13.58	+	
IVA	ROOM 143	EE45	37	26	0.7	4.55	5.00	-	13.64	-	(4)
IVA	ROOM 152.1	FF41	34	26	1	2.38	0.80	0.05	3.23	0.02	(4)
IVA	ROM 152.2	FF41	36	26	1	-	1.81	-	1.81	-	(2)
IVA	ROOM 154.1	FF41	42	35	1	0.16	-	0.02	0.18	0.11	(2)
IVA	JAR.1	DD41	54	52	0.7	6.07	17.04	-	33.01	-	4 kgG (3); (4)
IVA	JAR.2	DD41	54	52	?	4.11	13.04	-	?	-	(4)
IVA	JAR.3	DD41	55	52	0.4	0.47	8.35	-	22.05	-	5 kg (3)
IVA	JAR.4	DD41	56	52	0.6	13.22	17.56	-	62.30	-	7 kg (3)
IIIB	KILN 164	EE39	54	28	1	0.33	-	0.01	0.34	0.03	(2)
IIIB	HRTH 167	EE39	56	28	1	0.10	-	0.19	0.29	0.66	
IIIB	KILN 170	EE39	63	28	1	0.18	-	+	0.18	+	
IIIB	KILN 175.1	EE39	71	28	1	0.42	-	0.01	0.43	0.02	
IIIB	KILN 175.2	EE39	75	28	0.25	0.27	-	0.05	1.28	0.16	
IIIB	KILN 175.3	EE39	77, 78	28	3	7.65	-	0.35	2.67	0.04	
IIIB	PITX 172	EE39	65, 95	22	2	0.92	-	0.17	0.54	0.16	
IIIA	PITX 14	CC43	32	22	3	0.59	-	+	0.20	+	
IIIA	ROOM 111	EE39	96	48	1	0.49	-	0.03	0.52	0.06	
IIIA	ROOM 151.1	FF41	21	26	1.7	7.63	-	0.01	4.49	+	
III	POST 165	EE39	81	22	1	0.08	-	-	0.08	-	
III	POST 166	EE39	80	22	1	0.04	-	-	0.04	-	
III	POST 184	EE39	83	22	0.5	0.05	-	0.01	0.12	0.17	
II	HRTH 157	EE39	48	28	1	0.09	-	0.07	0.16	0.44	
II	PITX 85	DD41	71	22	1	0.02	-	-	0.02	-	25 kg (3)
II	PITX 147	FF41	27, 28	22	2	2.76	-	0.08	1.42	0.03	
II	DRNX	DD43	26	36	0.75	5.88	-	-	7.84	-	9 kg (3)
?	none	EE43	13	-	?	0.06	-	-	?	-	

(1) Feature abbreviations: CRDX=Corridor, COUR=Courtyard, DRNX=DRAIN, HRTH=Hearth. Other abbreviations: DC=deposit code, Volume (in 10 l. buckets), Charred dens.-density of charred material (in g/bucket), seed prop.=proportion (by weight) of seeds to total charred material (charcoal+reed+seed)
(2) Small mesh sieve used in field
(3) "Volume" of samples with weight indicated in comments is estimate
(4) Absolute and relative quantities of charcoal and reeds are estimates based on partial sorting for those samples containing reeds

APPENDIX C, TABLE 2. Seeds from EDD

BL	Feature	Square	Lot	Hordeum	Triticum	Cereal	Pulse	Nut	Fruit	Weed	Irrigated	Wet Area	Aeg gb	Unk
IVB	ROOM 151.2	FF 41	73	.	.	+	.	+ nut	.	1 Centaurea	.	1 Carex	.	.
IVA	ROOM 5	CC 43	25	0.01	.	0.01	.	.	.	.	.	3 Carex	.	.
IVA	CRDX 15	DD 45	13	0.33	.	1.02	.	.	1 Vitis	1 Galium	.	.	1	.
IVA	COUR 45.1	DD 43	66, 67	.	.	.	.	.	.	1 Gramineae	.	4 Carex	.	.
IVA	COUR 45.2	DD 43	69	0.28	.	0.68	+ Lens	.	+ Vitis	2 Galium	1 Borag	.	1	.
IVA	COUR 45.3	EE 45	30	0.01	.	+	.	0.01 Pist	.	.	.	.	.	.
IVA	COUR 45.4	EE 45	30	0.01	.	0.21	.	.	.	.	1 cf. Medicago	.	.	.
IVA	DOOR 59.1	DD 43	43	0.08	.	0.12	.	.	.	.	.	1 Carex	.	.
IVA	CRDX 60	DD 41	61	0.43	.	2.98	1 Lens	+ nut	.	2 Galium	1 cf. Malva	.	.	.
IVA	ROOM 69.2	DD 41	47	.	.	0.01	.	.	.	.	.	.	.	.
IVA	ROOM 69.3	DD 41	49	0.01	.	+	.	.	.	1 Adonis	.	.	.	.
IVA	CRDX 95	EE 43	26	0.01	.	0.06	.	.	.	1 Legum	.	.	.	.
IVA	ROOM 96	FF 41	37	.	.	+	.	.	.	.	.	.	.	.
IVA	CRDX 139.1	EE 45	28	.	.	.	1 Lens	0.01 Pist	.	.	.	.	.	.
IVA	CRDX 139.2	EE 45	32	.	.	.	0.5 Lens	+ Pist	.	.	.	.	.	2
IVA	DOOR 140	EE 45	33	.	.	0.05	1 Lens	+ cf. Pist	.	.	.	.	.	2
IVA	DOOR 141	EE 45	31	.	.	0.02	1 Lens	.	.	.	1 Fumaria	.	.	1
IVA	DOOR 142	EE 45	36	.	.	.	.	.	.	1 cf. Legum	.	.	.	.
IVA	ROOM 152.1	FF 41	34	.	.	0.04	1 Vicia	.	.	.	.	.	.	8
IVA	ROOM 154.1	FF 41	42	.	.	0.02	.	.	.	.	.	1 Setaria	.	.
IVA	JAR.4	DD 41	56	.	.	.	.	.	.	.	.	1 cf. Carex	.	.
IIIB	KILN 164	EE 39	54	.	.	0.01	.	.	.	.	.	.	.	.
IIIB	HRTH 167	EE 39	56	0.02	.	0.17	+ Lens	.	.	8 Gramineae-6 Galium-1 cf. Astrag-1	1 Borag	.	.	1
IIIB	KILN 170	EE 39	63	.	.	+	.	.	.	.	.	1 Setaria	.	.
IIIB	KILN 175.1	EE 39	71	.	.	0.01	.	.	.	1 Gramineae	.	.	.	.
IIIB	KILN 175.2	EE 39	75	.	.	0.05	.	.	.	.	.	.	.	.
IIIB	KILN 175.3	EE 39	77,78	0.06	+	0.21	1 Lens	0.05 Amyg-.04 A. sc-+ Pist-.01	1 Vitis	7 Crucif-1 Gramineae-4 Galium-1 Vaccaria-1	.	7 Setaria-6 Carex-1	.	.
IIIB	PITX 172	EE 39	65, 95	0.04	0.02	0.06	3.5 Lens	+ Pist	1 Vitis	3 Gramineae-1 Galium-2	2 Borag	6 Setaria	.	.
IIIA	PITX 14	CC 43	32	.	.	+	.	.	.	.	.	1 Carex	.	1
IIIA	ROOM 111	EE 39	96	0.01	.	0.01	.	0.01 Amyg-.01 Pist-+	+ Vitis	1 Gramineae	.	3 Setaria	.	.
IIIA	ROOM 151.1	FF 41	21	.	.	0.01	.	.	.	.	.	.	.	.
III	POST 184	EE 39	83	0.01	.	.	.	.	.	.	.	.	.	.
II	HRTH 157	EE 39	48	0.01	.	0.04	.	.	0.5 Celtis	4 Gramineae-2 Legum-1 Astrag-1	.	.	.	.
II	PITX 147	FF 41	27, 28	0.01	.	0.04	.	0.03 Pist	.	.	.	2 Setaria	.	.
II	DRNX 54	DD 43	26	.	.	+	.	.	.	.	.	.	.	.

Hordeum: (g)
Triticum: *T. aestivum/durum* (g)
Cereal: (g)
Pulse: includes *Lens, Vicia ervilia*
Nut: includes *Amygdalus* sp. (Amyg), *A. scoparia* (A. sc), *Pistacia* (Pist); (g)
Weed: includes Gramineae, *Vaccaria, Centaurea,* Cruciferae (Crucif), *Astragalus* (Astrag), Leguminosae (Legum), *Adonis* cf. *dentata, Galium*
Irrigated: includes Boraginaceae (Bor), *Medicago, Malva, Fumaria*
Wet Area: includes *Carex, Setaria*
Aeg gb: *Aegilops* glume base
Unk: Unknown

APPENDIX C, TABLE 3

Charcoal from Flotation Samples

Building Level	Provenience			*Populus* #	wt., g	*Fraxinus* #	wt., g	*Acer* #	wt., g	Other #	wt., g
IIIA	PIT 14	CC 43	32	—		—		—		3 *Quercus*	(.03)
										2 diff. por.	(.02)
										1 unk.	(.01)
IVA	ROOM 5	CC 43	25	40	(2.69)	—		—		—	
IVA	CRD 15	DD 45	13	8	(.42)	—		12	(1.05)	—	
IVA	DOOR 59	DD 43	43	15	(.45)	—		cf 3	(.11)	2 unk.	(.11)
IVA	CRD 60	DD 41	61	8	(.33)	—		—		—	
IVA	ROOM 69	DD 41	37	18	(1.73)	—		—		2 unk.	(.11)
IVA		DD 41	47	12	(.20)	8	(.14)	—		—	
IVA		DD 41	49	4	(.09)	—		—		—	
IVA	JAR	DD 41	54	1	(.01)	cf 1	(.01)	—		—	
IVA	JAR	DD 41	54	1	(.01)	—		—		2 Ulmac.	(.01)
IVA	JAR	DD 41	55	2	(.02)	cf 8	(.08)	—		—	
IVA	JAR	DD 41	56	16	(1.07)	cf 2	(.10)	—		2 unk.	(.12)
II	MISC	DD 43	26	2	(.10)	—	—	11	(.57)	3 Ulmac.	(.13)

Abbreviations: diff. por.: diffuse porous; Ulmac.: Ulmaceae; Unk.: unknown

APPENDIX C, TABLE 4

Hand-picked Charcoal

Building Level	Feature Number	Square	Lot	Types	Comments
IVA	ROOM 5	CC 43	9	*Populus*	
IVA		CC 43	25	*Populus*	3 samples
IVA		CC 43	25	*Populus/Salix, Fraxinus,* cf. *Acer,* reeds	2 small flotation samples submitted as miscellaneous
IVA	ROOM 12	CC 43	13	*Populus*	2 samples
IVA	CRD 15	CC 43	40	Ulmaceae, cf. *Celtis*	
IVA		CC 43	40	*Acer*	
IVA	ROOM 26	DD 45	20	*Populus*	
IVA	COUR 45	DD 43	43	*Populus*	
IVA		DD 43	43	cf. *Acer*	
IVA	CRD 60	DD 41	58	*Populus/Salix,* reed	from small miscellaneous flotation sample
IVA		DD 41	59	*Populus*	3 samples
IVA		DD 41	85	*Populus,* Ulmaceae, cf. *Celtis*	
IVA		DD 43	49	cf. *Acer*	
IVA	ROOM 69	DD 41	35	*Phragmites, Populus*	
IVA		DD 41	37	*Populus*	
IVA		DD 41	44	*Populus/Salix, Fraxinus,* reed	from miscellaneous flotation sample
IVA		DD 41	47	*Populus, Fraxinus*	
IVA		DD 41	84	*Populus, Phragmites*	
IVA	ROOM 76	DD 41	45	*Acer*	
IVA		DD 41	76	*Acer*	2 samples
IVA	CRD 139	EE 45	28	*Populus*	
IVA		EE 45	32	*Quercus*	
IVA		EE 45	?	*Quercus*	
IIIA	ROOM 151	FF 41	21	*Quercus*	
IVA	ROOM 152	FF 41	36	*Populus*	
IVA	? 26	CC 45	19	*Populus*	2 samples
IVA		CC 45	19	cf. *Juniperus*	
IVA	none —	DD 41	43	reeds	

APPENDIX C, TABLE 5

Charred Density

Seed Proportion	1.5 g/10 l	1.5 g/10 l
.1	15	19
.1	7	1

APPENDIX C, TABLE 6

Grain Density

(cereal and *Hordeum* wt. g/101)

CRD 60	2.7
CRD 15	1.7
COUR 45	1.0

25 samples grain density .25 g/10 l.
17 samples have no grain at all.

APPENDIX C, TABLE 7

Ubiquity of Hand-picked Charcoal

(total number of samples 28)

Populus/Salix	24
Acer	8
Fraxinus	4
Quercus	3
Ulmaceae	2
cf. *Juniperus*	1

Appendix D

Optical Mineralogy

by Chandra Reedy,
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Standard thin sections 0.03 mm in thickness were examined under a petrographic microscope (x200) in order to observe the mineralogical constituents and textural characteristics of the sherd samples.

M72 EE 41 L28 (TWO SAMPLES)

The porous clay contains a variety of small mineral grains. These include muscovite, very small specks of hematite, biotite, and a few grains of hornblende. The presence of numerous (approximately 7%) larger quartz grains, most 0.05 mm, with sharp and angular edges indicates that a sand temper may have been added. Many of these quartz grains show pronounced undulatory extinction. Plagioclase feldspar is also present, exhibiting both Carlsbad and albite twinning. Use of the Michel-Levy statistical method indicates that the plagioclase is probably labradorite. The presence of that mineral combined with undulatory quartz may indicate that the sand originates from a sediment deposit composed of material from a metamorphic origin. Some organic material has been added. The edges around the pores have altered to clay and cryptocrystalline quartz rather than to secondary calcite.

DD 43 L40 BANESH GOBLET

The sample contains hematite, muscovite, biotite, and plagioclase feldspar. Quartz may have been added as sand temper, since it occurs as larger angular grains ranging up to 0.2 mm. A few of these grains have undulatory or wavy extinction. The sample is distinguished by the presence of large amounts of calcite. Some of the calcite may have been added as a temper, with larger angular grains, which are much more common than the quartz. There are also small round calcite grains, which were probably originally in the clay. Some secondary calcite has also formed around the edges of the pores.

DD 43 L34 COOK POT

This sample is distinguished by the presence of a large amount of added calcite. The grains range up to 2.5 mm, and are sharply angular with clear rhombohedral outlines. The calcite is a major constituent of the sample, approximately 50%. No other temper is visible, and the remainder of the sample is composed of fairly pure clay.