Puerto Escondido (CR-372) Botanical Analysis from 1995 Field Season

Prepared by Rachel Cane, UC Berkeley
for Rosemary Joyce, UC Berkeley

UCB Archaeobotany Lab Report #46
May, 2001

Introduction

This report presents the results of paleoethnobotanical analysis of soil samples from 32 different loci at Puerto Escondido (CR-372) collected during the 1995 field season. Soil samples were floated in the field and the light fractions were sorted in the UCB Archaeobotany laboratory. Few taxa present could be identified due to poor preservation conditions, but botanical remains were classified as wood, parenchymous tissue ("lumps"), cupules from *Zea mays*, seeds, and other. Representatives of *Amaranthus*, *Nicotiana*, *Chenopodiaceae, Poaceae, and Fabaceae* were tentatively identified. The relative counts and weights of the different types of botanical remains present were analyzed in relation to their loci and associated features, and the results are presented here. Suggestions for optimizing field and laboratory procedures are recommended.

Methods

Field Methods

Soil samples were collected for flotation from a total of 32 excavated loci (*Table 1*). Samples were taken from selected loci based on their visible concentration of organic matter or association with particular features, such as burials and possible hearths. Two-liter sediment samples were taken from most loci. Some samples consisted of the entire contents of a locus, whether it was greater or less than 2 liters.

Soil samples were processed in the field using a simple hand-held flotation system. The light fraction was skimmed off the top of the water in the bucket with a sieve. Both the light and heavy fractions were dried on cloth squares. The corners of the cloth squares were tied to make small bags to store the contents of the light and heavy fractions.

Bags were labeled with their provenience (Operation-Suboperation-Locus), contents (heavy fraction or light fraction), and in some cases as "1 of 2" or "2 of 2." Most of the bags labeled "2 of 2" contained heavy fractions; in only two cases did they contain light fraction material. These samples were brought to the UCB Archaeobotany laboratory in 2000.

Laboratory Methods

In the laboratory, the 32 light fractions and 16 heavy fractions were assigned flotation numbers, and the light fractions were sorted under a microscope. Several of the heavy fractions were spot checked for botanical remains, but as none were found, the heavy fractions were not sorted. The botanical contents of the light fractions were identified, recorded, and entered into a relational database.

Light fractions were transfered with their original labels from their cloth bags into plastic zip-lock bags. Laboratory flotation numbers (1001 - 1041) were assigned to each floated sample (*Table 2*). Each flot number corresponds to one floated soil sample, including both its light and heavy fraction. Both light and heavy fractions were present for 10 of the loci, light fractions with no heavy fractions were present for 21 loci, and one locus only had a heavy fraction. For

samples with two bags, separate float numbers were assigned to bag "1 of 2" and bag "2 of 2". Four individual flot numbers were assigned to heavy fractions labeled "2 of 2" with no corresponding light fraction; since the heavy fractions were not sorted, these float numbers were not included in the analysis. Two samples were mistakenly given two flot numbers each, and one flot number was misassigned to a sample that did not exist.

In the laboratory, light fractions were sifted through 2.0mm, 1.0mm, and 0.5mm geological screens. Three samples were too small to be screened; these were sorted as one fraction and the botanical remains in them were assigned a screen size from their measurements. Samples from each screen were sorted under a stereoscope microscope and the botanical material was picked, identified, and curated in gel caps. Gel caps were labeled with the flot number, provenience, screen size, and type of material. Wood less than 2.0mm was not picked, and lumps less than 1.0mm without edges were not picked, as per standard lab procedures. Material less than 0.5mm was saved but not sorted. Sorted items were counted and weighed. All the material from each flot number (gel caps, and plastic bags with the remaining material from each of the screens) were stored together in a cardboard box labeled with the float number.

Each flot sample's data was recorded on a form. The data for several flot numbers was first recorded on makeshift forms and then transfered to the standard forms. All information on the forms were entered into the database. Data was exported into a spreadsheet for analysis.

Results

Soil samples contained wood, parenchymous tissue ("lumps"), cupules from *Zea mays*, seeds, and other botanical material (*Tables 3 and 4*). Only charred remains were considered archaeological. The identification of specific taxa was often difficult due to poor preservation and surface erosion, but a small number of representatives of *Amaranthus*, *Nicotiana*, *Chenopodiaceae, Poaceae, and Fabaceae* were tentatively identified. The number of botanical remains recovered from each locus varied, but on the whole samples yielded relatively low counts and weights (*Figures 1 and 2*).

Wood was one of the most common items recovered, which is usual for domestic contexts in temperate regions. Wood greater than 2.0mm was recovered from 23 loci, or 72% ubiquity. Each of the samples from 32 loci yielded an average of 10.6 pieces of wood with a mean weight of 0.074g per sample. By far the most wood collected from any sample was from flot number 1008 (4AH-21), with 90 pieces of wood weighing a total of 0.87g. The median number of pieces of wood for all loci was 3, with a median weight of 0.017g.

Lumps were recovered from 25 loci, or 78% ubiquity. As noted above, all lumps greater than 1.0mm and lumps with edges less than 1.0mm were picked. An average of 15.2 lumps were recovered in each locus, with an average total weight of 0.015g. A remarkably high 334 lumps weighing 0.31g were collected from flot number 1022 (4DP-25). The next highest lump count was in flot number 1008 (4AH-21), with 36 pieces weighing 0.028g, and the next highest total weight was in flot number 1032 (4P-9), with 21 pieces weighing 0.042g. The median number of lumps collected from all loci was 2 and the median weight was 0.001g. Three flat, thin types of parenchymous tissue under 1.0mm were found in flot number 1008 (4AH-21) and these were labeled as "lump B".

Cupules from *Zea mays* were found in 13 of the samples, or 40% ubiquity. An average of 10.7 cupules were recovered per locus, averaging a total weight of 0.025g. Flot number 1022 (4DP-25) far outstripped any other sample for both cupule count and weight, with 276 cupules

weighing 0.742g. The next highest concentration of cupules was recovered from flot number 1004 (4AH-5), with 21 cupules weighing 0.034g. The median number of cupules collected from all loci was 0 with a corresponding median weight of 0.00g. Cupule size varied, and cupules were found in material from all three screens. The condition of cupules also varied greatly, and many cupules recovered from 1022 (4DP-25) appeared particularly squashed and eroded.

Seeds were recovered in samples from 12 different loci, or 38% ubiquity. An average of less than one seed per locus, however, was found, with 8 seeds each in 1008 (4AH-21) and 1022 (4DP-25). The weight of all seeds recovered was negligible. Of the 28 total seeds recovered from all the samples, 25 were unidentifiable due to their level of erosion or fragmentary condition. Flot number 1002 (4AH-2) contained one seed tentatively identified as *Amaranthus sp.*, and one *cf. Nicotiana* was tentatively identified in flot number 1021 (4DP-15). What appears to be the inside of a member of the *Chenopodiaceae* family with the embryo missing was found in 1008 (4AH-21).

Other botanical material found were parts of possible *Poaceae*, possible *Fabaceae*, and unidentified botanicals. Members of the *Poaceae*, or grass, family were found in two flot samples, or 6% ubiquity. The node of a grass stalk from which a stem broke off was found in 1008 (4AH-21). 1022 (4DP-25) contained what appeared to be 6 rachis-like attachments for a type of grass. Three possible members of the *Fabaceae* family were found in three different samples (9% ubiquity)—1025 (4G-4), 1028 (4G-6), and 1039 (4Y-7). The legume in the third context appeared to have been subjected to high heat; it had lost its attachment scar and its insides were melted beyond real identification. A total of 60 other unidentified botanical remains were found in six other contexts (19% ubiquity). These included other possible stems, possible glumes, flat and dense material most likely mesocarp or exocarp, and hard, nut-like material. The vast majority of unidentified botanicals (n=54) were recovered from 1022 (4DP-25).

Analysis

Time

Figures 1 and 2 show the total number and weights of botanical remains recovered in each context. The loci are grouped by phase: 4AM-13 to 4CU-6 are dated to the Middle Formative, 4AL-3 to 4P-9 are Early Classic, and the remaining loci are Late Classic. Most botanical remains recovered are from Late Classic contexts.

Context

Comparison among loci is not possible because the volumes of sediment floted from each locus is not available, but several contexts are of particular interest and merit discussion. The greatest number and greatest diversity of organic remains came from flot #1022 (4DP-25), a deep pit below a Late Classic adult burial filled with earlier Classic trash. 334 lumps and 276 cupules were recovered in this locus. Most of the unidentifiable botanical remains came from this locus (n=54), including all occurences of the hard, nut-like material and the flat and dense material thought to be mesocarp or exocarp. Unfortunately, the condition of materials in 4DP-25 prohibited identification of these materials; likewise none of the 8 seeds found could be identified. The materials in 4DP-25, especially the squashed cupules, showed evidence for heat-related and mechanical deformation. It may be significant that 4DP-25 did not contain the highest number of wood remains, either by count or by weight.

Flot #1008 (4AH-21) generally represents the next highest number of organic remains. This locus is the lowest level of the mottled and lensed contents of a bell-shaped pit (4AH-11), possibly used for below-ground storage. The pit was not completely excavated, but it appears to have been filled with trash in primary deposition, including elaborately decorated ceramics interpreted as brewing and drinking cups. Flot numbers 1005 (4AH-16), 1006 (4AH-17), and 1007 (4AH-18) also represent the contents of this pit at higher stratigraphic levels. These loci also contain a significantly high number of botanical remains. Interestingly, pit 4AH-11 has a much higher number of carbonized wood remains than pit 4DP-25.

Suggestions for Future Procedures

The following are some suggestions for optimizing the procedures for collection, recovery, and analysis of macrobotanical remains at CR-372.

1) Sample size

Given the relatively low amount of botanical remains recovered in mostly 2-liter soil samples, it is recommended that 10-15 liter soil samples be collected for flotation. Based on a mean yield of roughly 37 items per two liters of sediment, an average of 180 to 280 items may be expected to be recovered in 10-15 liter samples. This also helps increase the likelihood of finding identifiable remains strengthens overall patterns in relative concentrations among the samples. Sediment volume should be measured and recorded to the 0.5 liter before flotation.

2) Sampling strategy

A probabilistic sampling strategy may be beneficial for paleoethnobotanical analysis at CR-372. This would help establish a baseline for comparing concentrations of botanical remains in different contexts and perhaps show general or unexpected patterns within the site. Probabilistic sampling would also allow for analytic statistics to be applied to the results.

The optimal sampling strategy may have two parts: a probabilistic sample may be taken from every particular number of sub-operations (depending on the percent coverage desired), while a judgment sample may be taken from particularly interesting contexts. The type of sampling strategy used should be noted for each sample. If possible, sampling from each sub-operation for 100% coverage is optimal. Floted samples can be subsampled in the laboratory for sorting and analysis.

3) Flotation methods

The compact, clayey soil at CR-372 is difficult to disperse in water, often leaving light fraction materials sediment covered and therefore hard to identify. It is possible that soaking the sample in water for half an hour before flotation, increased agitation, or the addition of deflocculent to the water such as hydrogen peroxide would help break up the soil and result in a cleaner light fraction. Experimenting with these different ways to optimize flotation will be helpful.

4) Collection log

A collection log may aid excavators in taking consistent soil samples. Information on the soil sample collection log may include: provenience (operation, sub-op, locus, and depth),

description of context, description of soil matrix, volume of soil, type of sampling strategy, date, name of excavator.

5) Flotation records

It is recommended that each soil sample receive a flotation number when it is floated in the field and a flotation record kept for it. Information on each flotation sample should include: flot number, provenience, flotation method (including special cleaning procedures or deflocculents), size of sieve used for collecting light fraction, date floted, name of floter. The light and heavy fractions recovered may be labeled with this flotation number.

6) Sorting and botanical analysis forms

A botanical analysis form should be designed before any sorting is done. Scanning of several samples will help determine expected taxa or types of botanical remains to be included on the forms. All sorting notes from each sample should be entered by hand onto the sample's form, and any changes or corrections made to the form should be marked by hand so that there is a record of the changes. The final version of the forms can be entered into the computer database to complete statistical analysis.

Conclusion

The collection and recovery of botanical remains at CR-372 certainly demonstrates variation in the concentrations and diversity of materials across the site in different contexts, as well as identifying certain specific taxa present at the site. Although the overall amounts of botanical remains recovered across the site was generally low, trash pits 4DP-25 and 4AH-11 (4AH-16,17,18,21 are the contents) yielded relatively high concentrations of macrobotanical remains. But while 4AH-11 appears to have a more standard proportion of wood, 4DP-25 seems to have included many more cupules of *Zea mays* and unidentified parenchymous tissue than wood remains, suggesting that it was a food processing and consumption dump.

The only identifiable taxa that occurs consistently in the samples is *Zea mays*. Tentative identifications of *Amaranthus*, *Nicotiana*, *Chenopodiaceae,* other *Poaceae,* and *Fabaceae* indicate that these taxa may have been present at the site, but the nature of their use is difficult to determine. Some wood fragments may be able to be identified by specialists.

Less than optimal conditions for preservation at CR-372 present a challenge for paleoethnobotanical analysis at the site. Recommendations for optimizing the collection, recovery, and analysis of botanical remains at CR-372 include increasing the standard sample volume to 10-15 liters, incorporating a probabilistic sampling strategy, experimenting with flotation techniques for cleaning the light fraction, and standardizing the recording process in all stages of work.

Table 1: Loci sampled

Op	Subop	Locus	Date	Comments on Locus (depths in meters above sea level)
4	AC	4	LC	Carbon stained contents of pit 4AC-5 at 27.59-27.50
4	AH	2	LC	Ashy pit contents of 4AH-24 at 27.51-27.47; contents above 4AH-2
4	AH	5	LC	Ashy pit contents of 4AH-24 at 27.51-27.47; contents below 4AH-2
4	AH	16	LC	Mottled and lensed contents of "bell-shaped" pit 4AH-11 at 27.38-27.33
4	AH	17	LC	Mottled and lensed contents of "bell-shaped" pit 4AH-11 at 27.33-27.23
4	AH	18	LC	Mottled and lensed contents of "bell-shaped" pit 4AH-11 at 27.23-27.10
4	AH	21	LC	Mottled and lensed contents of "bell-shaped" pit 4AH-11 at 26.91-26.73
4	AL	3	EC	4AL was the plastered surface summit of upper terrace of platform
4	AL	7	EC	Contents of contents of burned clay lined shallow pit 4AL-6 (apparent hearth) at 27.60-27.58.
4	AL	7A	EC	Contents of contents of burned clay lined shallow pit 4AL-6 (apparent hearth) at 27.60-27.58.
4	AM	13	MF	Matrix around clay hearths at 27.55-27.53.
4	AS	9	EC	Internal space in building: 4AS-9 was ashy grey circular deposit on a surface cut by burials at 27.57-27.51.
4	AU	8	EC	Carbon flecked soil below and around burned clay feature (probably extramural hearth) at 27.62=26.54 m.
4	AV	3	EC	Ashy contents of burned clay pit feature 4AV-5 (apparent u-shaped shallow hearth) at 27.61-27.54 m—one of five circular features at this level in this unit.
4	AW	12	MF	Sediment from inside complete cached vessel 4AW-9 at 27.58-27.47.
4	CU	6	MF	Contents of shallow pit feature, also labeled 4CU-6, in center of rectangular enclosure at 27.61-27.49.
4	D	15	LC	Dark organic lens in matrix of juvenile burial, 27.16-26.86.
4	DP	25	LC	Deep pit at 27.49-27.32 filled with earlier classic trash. Contents should have been labeled 4DP-19.
4	DZ	2	LC	Carbon stained contents of shallow circular pit feature 4DZ-6 at 27.63-27.50.
4	F	6	EC	General matrix from 27.56-27.54; one of set of units on northern extreme of excavation.
4	G	4	EC	General matrix from 27.51-27.43; one of set of units on northern extreme of excavation.
4	G	6	EC	Burned clay lined pit contents at 27.55-27.47, interpreted as a hearth.
4	G	21	EC	Dark sediment contained inside horseshoe-shaped orange stain 4G-20, 27.48-27.30, interpreted as a hearth.
4	I	14	LC	Contents of black stained circular feature, one of 6 similar features, located at depth of 27.55-27.48, surface intruded on by burial.
4	P	9	EC	Half the ashy contents of pit 4P-7, located at depth of 27.27-27.22, dug from surface predating burial.
4	R	7	LC	Matrix of heavily disturbed juvenile burial pit between 27.56-27.52.
4	R	13	LC	Part of matrix of heavily disturbed juvenile burial.
4	R	15	LC	Contents of orange burned clay circular feature (interpreted as a hearth), also assigned locus 15, 27.58-27.56.
4	T	7	LC	Orange clay lining shallow pit at 27.52-27.43.
4	T	8	LC	Carbon stained contents of shallow pit 4T-7 at 27.59-27.52.
4	Y	7	LC	Matrix of burial 4Y-7A at 27.51-27.45.
4	Y	9	LC	Carbon in burned area on NE of unit, possibly part of burial matrix, at 27.52-27.48.

Table 2: Flotation numbers

Flot #	Op	Subop	Locus	Bag #	LF	HF	Comments
1001	4	AC	4	1 of 1	X	none	
1002	4	AH	2	1 of 2	X	X	Used only 0.5mm screen.
1003	4	AH	2	2 of 2	none	X	
1004	4	AH	5	1 of 1	X	none	
1005	4	AH	16	1 of 1	X	none	
1006	4	AH	17	1 of 1	X	none	
1007	4	AH	18	1 of 1	X	none	
1008	4	AH	21	1 of 1	X	none	
1009	4	AL	3	1 of 1	X	X	
1010	4	AL	7	1 of 2	X	X	
1011	4	AL	7	2 of 2	none	X	
1012	4	AL	7A	1 of 1	X	none	
1013	4	AM	13	1 of 1	X	X	
1014	4	AS	9	1 of 1	X	X	
1015	4	AU	8	1 of 2	X	X	
1016	4	AU	8	2 of 2	none	X	
1017	4	AV	3	1 of 2	X	X	
1018	4	AV	3	2 of 2	none	X	
1019	4	AW	12	1 of 1	X	X	
1020	4	CU	6	1 of 1	X	none	Sample too small to screen.
1021	4	D	15	1 of 1	X	none	
1022	4	DP	25	1 of 1	X	none	
1023	4	DZ	2	1 of 1	X	none	
1024	4	F	6	1 of 1	X	none	
1025	4	G	4	1 of 1	X	none	
1026							Flot # mistakenly assigned to same sample as #1028.
1027	4	G	6	2 of 2	X	none	
1028	4	G	6	1 of 2	X	none	
1029							Flot # mistakenly assigned to same sample as #1027.
1030	4	G	21	1 of 1	X	none	
1031	4	I	14	1 of 1	X	X	
1032	4	P	9	1 of 1	X	none	
1033							Flot # misassigned.
1034	4	R	13	1 of 1	X	none	
1035	4	R	15	1 of 1	none	X	
1036	4	R	15	1 of 1	X	none	Sample too small to screen
1037	4	T	7	1 of 1	X	none	
1038	4	T	8	1 of 1	X	none	
1039	4	Y	7	1 of 2	X	X	
1040	4	Y	7	2 of 2	X	X	
1041	4	Y	9	1 of 1	X	none	

Table 3: Counts of Botanical Remains Recovered

Locus	Phase	Wood	Cupules	Lumps	Seeds
4AM-13	MF	0	0	1	1
4AW-12	MF	0	0	4	0
4CU-6	MF	2	0	0	0
4AL-3	EC	1	0	0	0
4AL-7	EC	1	0	1	0
4AL-7A	EC	1	0	1	0
4AS-9	EC	0	0	1	0
4AU-8	EC	5	0	13	0
4AV-3	EC	4	0	5	1
4F-6	EC	24	1	0	0
4G-4	EC	1	0	1	0
4G-6	EC	4	1	2	0
4G-21	EC	9	0	6	0
4P-9	EC	11	4	21	0
4AC-4	LC	26	0	0	1
4AH-2	LC	0	5	2	1
4AH-5	LC	8	21	1	0
4AH-16	LC	43	2	6	1
4AH-17	LC	20	8	14	2
4AH-18	LC	19	2	11	0
4AH-21	LC	90	18	36	8
4D-15	LC	9	1	3	1
4DP-25	LC	42	276	334	8
4DZ-2	LC	10	2	12	1
4I-14	LC	0	0	1	1
4R-7	LC	0	0	0	0
4R-13	LC	0	0	0	0
4R-15	LC	1	0	2	0
4T-7	LC	0	0	0	0
4T-8	LC	0	0	2	0
4Y-7	LC	7	0	3	2
4Y-9	LC	1	1	3	0
mean		10.59375	10.6875	15.1875	0.875
median		3	0	2	0

Table 4: Weights of Botanical Remains Recovered

Locus	Date	Wood (g)	Cupules (g)	Lumps (g)
4AM-13	MF	0	0	0
4AW-12	MF	0	0	0.001
4CU-6	MF	0.002	0	0
4AL-3	EC	0.001	0	0
4AL-7	EC	0.004	0	0.001
4AL-7A	EC	0.013	0	0
4AS-9	EC	0	0	0
4AU-8	EC	0.016	0	0.003
4AV-3	EC	0.018	0	0.004
4F-6	EC	0.097	0.002	0
4G-4	EC	0.03	0	0
4G-6	EC	0.034	0	0.006
4G-21	EC	0.06	0	0.002
4P-9	EC	0.085	0.002	0.042
4AC-4	LC	0.156	0	0
4AH-2	LC	0	0.005	0.01
4AH-5	LC	0.046	0.034	0.011
4AH-16	LC	0.334	0.001	0.001
4AH-17	LC	0.122	0.002	0.025
4AH-18	LC	0.115	0.006	0.033
4AH-21	LC	0.87	0.018	0.028
4D-15	LC	0.075	0.002	0.005
4DP-25	LC	0.196	0.742	0.313
4DZ-2	LC	0.045	0.002	0.005
4I-14	LC	0	0	0
4R-7	LC	0	0	0
4R-13	LC	0	0	0
4R-15	LC	0.001	0	0.001
4T-7	LC	0	0	0
4T-8	LC	0	0	0
4Y-7	LC	0.053	0	0.001
4Y-9	LC	0.004	0.001	0.003
mean		0.07428125	0.02553125	0.01546875
median		0.017	0	0.001

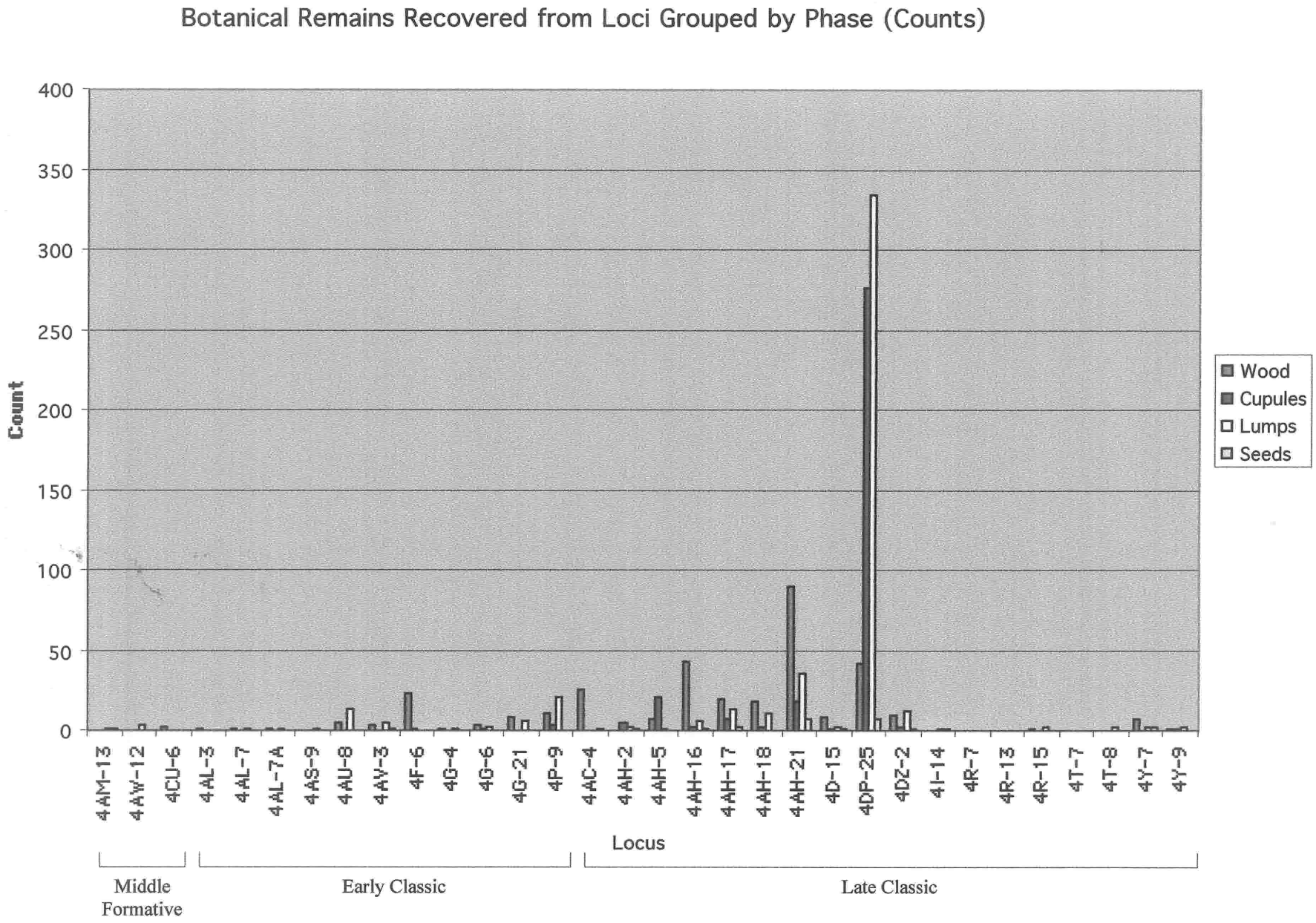
Botanical Remains Recovered from Loci Grouped by Phase (Counts)
Count
400
350
300
250
200
150
100
50
0
Wood
Cupules
Lumps
Seeds
4AM-13
4AW-12
4CU-6
4AL-3
4AL-7
4AL-7A
4AS-9
4AU-8
4AV-3
4F-6
4G-4
4G-6
4G-21
4P-9
4AC-4
4AH-2
4AH-5
4AH-16
4AH-17
4AH-18
4AH-21
4D-15
4DP-25
4DZ-2
4I-14
4R-7
4R-13
4R-15
4T-7
4T-8
4Y-7
4Y-9
Locus
Middle Formative
Early Classic
Late Classic

Figure 1

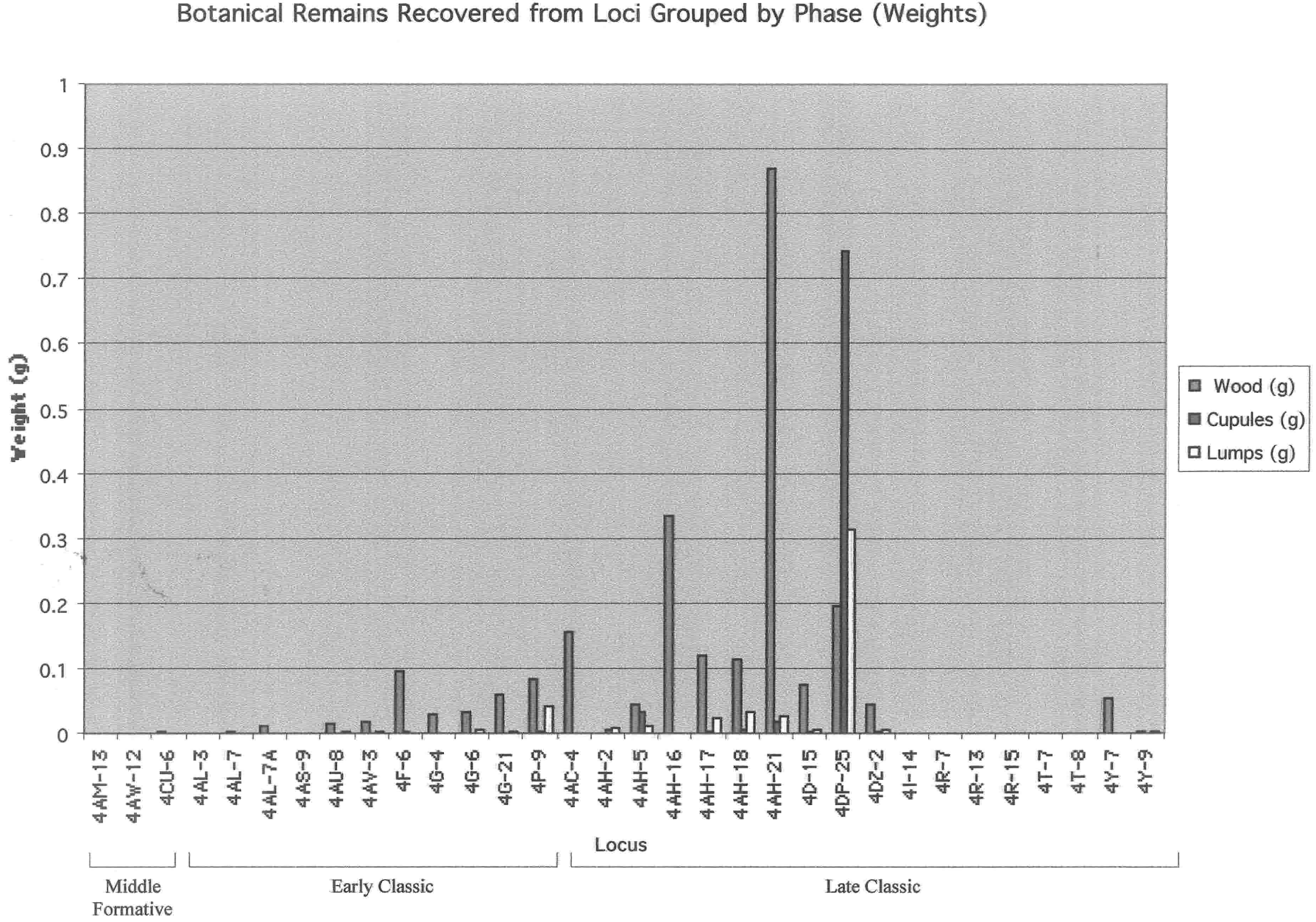
Botanical Remains Recovered from Loci Grouped by Phase (Weights)
Weight (g)
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Wood (g)
Cupules (g)
Lumps (g)
4AM-13
4AW-12
4CU-6
4AL-3
4AL-7
4AL-7A
4AS-9
4AU-8
4AV-3
4F-6
4G-4
4G-6
4G-21
4P-9
4AC-4
4AH-2
4AH-5
4AH-16
4AH-17
4AH-18
4AH-21
4D-15
4DP-25
4DZ-2
4I-14
4R-7
4R-13
4R-15
4T-7
4T-8
4Y-7
4Y-9
Locus
Middle Formative
Early Classic
Late Classic

Figure 2