Flotation Data Sampling Strategies in Archaeological Research: An Experiment at the Elam Site (20AE195), Allegan County, Michigan

Brian David DeRoo

Follow this and additional works at: https://scholarworks.wmich.edu/masters_theses

Part of the History of Art, Architecture, and Archaeology Commons, and the Paleobiology Commons

Recommended Citation
https://scholarworks.wmich.edu/masters_theses/974
FLOTATION DATA SAMPLING STRATEGIES IN ARCHAEOLOGICAL RESEARCH: AN EXPERIMENT AT THE ELAM SITE (20AE195), ALLEGAN COUNTY, MICHIGAN

Brian David DeRoo, M.A.
Western Michigan University, 1991

Studies of prehistoric Native American subsistence patterns have benefited greatly from data recovered through the technique of flotation, which allows investigators to recover small scale organic remains which would otherwise be missed using standard excavation procedures. Using data recovered through flotation, researchers have been able to more fairly evaluate the role of plant foods, both wild and cultivated, in the aboriginal diet.

A common method of obtaining a flotation sample is to define a column through the center of the cultural feature or midden and removing a specified volume of soil matrix (usually 10 liters) from this column. This thesis project is designed to test the effectiveness of this data recovery technique at Elam, a Woodland Period site in Allegan County, Michigan. Six prehistoric pit features were selected for this study. After the excavation of half of the feature to obtain a profile, a 20 cm flotation column was defined and removed, followed by the removal of the remaining half of the feature as an extra flotation sample. The objective was to evaluate how well the data from the column represented the contents of the feature as a whole. This thesis describes the experiment and its results.
ACKNOWLEDGEMENTS

I would like to express my appreciation to everyone who contributed their suggestions, advice, and assistance during the course of my thesis project. First of all, I thank my thesis advisor, Dr. Elizabeth Garland, for her assistance in the field at the Elam site and for her constant encouragement and support. I owe a debt of gratitude to Dr. William Cremin, another member of my thesis committee, who helped me develop an interest in paleoethnobotany. Dr. Allen Zagarell, the third member of my committee, deserves recognition for his helpful suggestions concerning my thesis.

I wish to especially acknowledge the contribution of Katie (Parachini) Parker, who did the botanical analysis for Elam's 1978 field season. Her thesis has served as a model and inspiration to me.

Appreciation is extended to Sandra Dunovan and Dr. Richard Ford of the University of Michigan Ethnobotany Laboratory, Ann Arbor, for their immeasurable contribution to my archeobotanical education. I also thank David DeFant, Dale Quattrin and Marc Custer, each of whom made indispensable contributions during the course of my study.

I am grateful to my parents, Shirley and Edward DeRoo, for their generous aid and support. Finally, I wish to thank my wife Hyesuk, for providing the love and endless patience which made completion of this thesis possible.

Brian David DeRoo
INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI
University Microfilms International
A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700  800/521-0600

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Flotation data sampling strategies in archaeological research: An experiment at the Elam Site (20AE195), Allegan County, Michigan

DeRoo, Brian David, M.A.
Western Michigan University, 1991
# TABLE OF CONTENTS

ACKNOWLEDGEMENTS ......................................................... ii
LIST OF TABLES ............................................................... vi
LIST OF FIGURES ............................................................. vii

CHAPTER

I. INTRODUCTION ............................................................... 1

II. THE ELAM SITE ............................................................. 3

  Site Setting ................................................................. 3
  Summary of Investigations .............................................. 6
  The Late Woodland Component ................................. 6
  Late Woodland Features .............................................. 6
    Type A ................................................................. 7
    Type B ................................................................. 7
    Type C ................................................................. 8
    Type D ................................................................. 8
    Untyped ............................................................... 8
  Subsistence Data ....................................................... 8
  Previous Investigation ................................................. 11

III. THE FLOTATION EXPERIMENT ................................. 14

  Field Methodology ..................................................... 14
  Laboratory Methodology ............................................. 15

IV. RESULTS OF THE EXPERIMENT ................................. 17

  Feature 84 ............................................................... 17
    Carbonized Seeds ............................................... 19
Table of Contents—Continued

<table>
<thead>
<tr>
<th>CHAPTER</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonized Nutshell</td>
<td>22</td>
</tr>
<tr>
<td>Carbonized Tubers</td>
<td>23</td>
</tr>
<tr>
<td>Seasonality</td>
<td>23</td>
</tr>
<tr>
<td>Feature 85</td>
<td>23</td>
</tr>
<tr>
<td>Carbonized Seeds</td>
<td>25</td>
</tr>
<tr>
<td>Seasonality</td>
<td>26</td>
</tr>
<tr>
<td>Feature 86</td>
<td>26</td>
</tr>
<tr>
<td>Carbonized Seeds</td>
<td>27</td>
</tr>
<tr>
<td>Carbonized Nutshell</td>
<td>28</td>
</tr>
<tr>
<td>Seasonality</td>
<td>28</td>
</tr>
<tr>
<td>Feature 87</td>
<td>30</td>
</tr>
<tr>
<td>Carbonized Seeds</td>
<td>31</td>
</tr>
<tr>
<td>Carbonized Nutshell</td>
<td>33</td>
</tr>
<tr>
<td>Seasonality</td>
<td>34</td>
</tr>
<tr>
<td>Feature 93</td>
<td>34</td>
</tr>
<tr>
<td>Carbonized Seeds, Tubers and Nutshell</td>
<td>34</td>
</tr>
<tr>
<td>Seasonality</td>
<td>37</td>
</tr>
<tr>
<td>Feature 98</td>
<td>37</td>
</tr>
<tr>
<td>Carbonized Nutshell</td>
<td>39</td>
</tr>
<tr>
<td>Seasonality</td>
<td>41</td>
</tr>
<tr>
<td>Wood Charcoal (All Features Combined)</td>
<td>41</td>
</tr>
<tr>
<td>V. DISCUSSION AND CONCLUSIONS</td>
<td>44</td>
</tr>
<tr>
<td>Carbonized Seeds</td>
<td>44</td>
</tr>
<tr>
<td>Carbonized Nutshell</td>
<td>48</td>
</tr>
</tbody>
</table>
Table of Contents--Continued

Carbonized Tubers ................................................................. 49
Cultivated Plants ................................................................. 50
Wood Charcoal ................................................................. 51
Conclusions ................................................................. 53

APPENDICES

A. Contents of Flotation Samples ........................................... 57
B. Detailed Comparison of Material Collected From Flotation Column
   Samples and 50% Samples of Features ................................. 60

BIBLIOGRAPHY ................................................................. 76
LIST OF TABLES

1. Carbonized Seeds, Nutshell and Tubers From Feature 84 ..........................20
2. Carbonized Seeds From Feature 85 ...............................................................26
3. Carbonized Seeds and Nutshell From Feature 86 .................................28
4. Carbonized Seeds and Nutshell From Feature 87 .................................31
5. Carbonized Seeds, Nutshell and Tubers From Feature 93 .....................37
6. Carbonized Seeds and Nutshell From Feature 98 .................................39
7. Comparisons of Archaeobotanical Data ....................................................45
8. Carbonized Seeds, Nutshell and Tubers From All Features Combined ......46
## LIST OF FIGURES

1. Sites Mentioned in Text ................................................................. 4
2. Map of Forest Types Adjacent to Elam Site ................................. 5
3. Profile of Feature 84 ................................................................. 18
4. Percentages of Seed Taxa in Column Sample and 50% Sample of Feature 84 ......................................................... 21
5. Frequencies of Rubus, Galium and Prunus Seeds From Column Sample and 50% Sample of Feature 84 ........................................ 22
6. Seasonal Availability of Plant Taxa Recovered in Column Sample and 50% Sample of Feature 84 ......................................................... 24
7. Profile of Feature 85 ................................................................. 25
8. Profile of Feature 86 ................................................................. 27
9. Seasonal Availability of Plant Taxa Recovered in Column Sample and 50% Sample of Feature 86 ......................................................... 29
10. Profile of Feature 87 ................................................................. 30
11. Percentages of Seed Taxa in Column Sample and 50% Sample of Feature 87 ......................................................... 32
12. Frequencies of Fragaria and Galium Seeds From Column Sample and 50% Sample of Feature 87 ......................................................... 33
13. Seasonal Availability of Plant Taxa Recovered in Column Sample and 50% Sample of Feature 87 ......................................................... 35
14. Profile of Feature 93 ................................................................. 36
15. Profile of Feature 98 ................................................................. 38
16. Carbonized Nutshell From Column Sample and 50% Sample of Feature 98 ......................................................... 40
17. Wood Charcoal Composition (in Percent by Weight) of Column Samples and 50% Samples of Features 84, 85, 86, 87, 93 and 98 ......................................................... 42
18. Wood Charcoal Composition (in Percent by Weight) of Column Samples and 50% Samples of All Features Combined ......................................................... 52

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
CHAPTER I

INTRODUCTION

Since the widespread adoption of the flotation data recovery method in the late 1960s (Stuever 1968), the taking of flotation samples has become a standard procedure at archaeological sites throughout the United States. The result has been an exponential increase in the subsistence data available to investigators, which has brought with it a far greater understanding of the importance of plant foods in the aboriginal diet and allowed the formulation of more sophisticated theories regarding cultural processes which led to the origins of cultivation in the Americas. Along with this flotation revolution have come methodological problems involving data collection and sampling methods. Because processing, sorting, quantification and analysis of archaeobotanical remains is very labor intensive, the need for proper sampling is particularly urgent. Although the fledgling discipline of archaeobotany suffered from an uneven spread of knowledge and the lack of standardization during the 1970s and early 1980s, in recent years comprehensive treatments of methodological considerations have been published (Hastorf and Popper 1988; Pearsall 1989; Watson, LeBlanc and Redman 1984). Thus, the research designs of the field archaeologist as well as the archaeobotanist are responding to the challenge of testing hypotheses which are growing ever more sophisticated, creating a feedback loop as the quantum proliferation of new flotation data give rise to more complex questions.

The flotation sampling method used at the Elam site has been the column method as employed by archaeologists at Western Michigan University, Kalamazoo (Parachini 1984). After bisecting a feature to obtain a profile, a 20 X 20 cm column
is defined vertically and excavated at the center of the feature. A 10 liter sample of soil matrix is removed from each stratigraphic zone of the feature for processing and analysis. If 10 liters are not available from a particular stratigraphic zone, the largest possible sample is taken.

The column sampling method provides a degree of standardization for purposes of evaluation of archeobotanical evidence within and between sites. Flotation analysis of larger sized samples is usually prohibitive in terms of laboratory time expended. The column approach allows recovery of a manageable volume of soil matrix from a large number of features. But are 10 liters sufficient to identify the presence and relative abundance of constituents in the archaeobotanical record? Would a larger sample yield data more representative of the feature contents as a whole? It would perhaps be instructive to look at a much larger sample of the feature and compare it to the contents of the column alone. We decided to implement this procedure for a population of six Late Woodland features at the Elam site. After a profile of the feature was obtained, a flotation column sample was taken, followed by the removal of the remaining feature matrix as an extra sample. Thus, in all, half the soil matrix of each feature was taken for flotation. In this thesis, "50% sample" will be used to refer to the total amount of soil matrix removed from a feature. The "column sample" is the fraction of the 50% sample which is located within the 20 cm column as defined in the field. The purpose of this thesis is to compare and contrast the contents of the column sample alone to those of the whole 50% sample.

Chapter II gives a brief introduction to the Elam site and the subsistence data recovered from the Late Woodland component of the site. Chapter III describes how the experiment was operationalized. Chapter IV details the results of the experiment, and Chapter V discusses the results and their implications.
CHAPTER II

THE ELAM SITE

Site Setting

The Elam site is located on the Kalamazoo River in Allegan County, Michigan, 39 km upstream from Lake Michigan. It is located in a small meadow on the south bank of the river, flanked on the west by a terrace 4 m above the field, and on the east by a swampy woodland (Barr 1979:7; Parachini 1981:6-12). Late Woodland occupation has been detected in limited excavations both on the terrace and in the woods. Two other Late Woodland sites are located within 1 km of Elam: the Allegan Dam site (Spero 1979) across the river and the Calkins Bridge site (Garland ed. 1984a), approximately 0.5 km upstream from Elam (Figure 1).

The Kalamazoo River near the Elam site is flanked by extensive swamplands, creating a mosaic of wetland communities dominated by species such as black willow, sycamore, red maple, American elm and black ash (Figure 2). The area directly adjacent to Elam on the south side of the river is oak/pine woodland. Surrounding this oak/pine zone on both sides of the river is a broad region of beech-maple forest, the dominant forest community in much of lower Michigan. The Elam site itself is a small field, dominated by commensal plants (grasses, nettles, blackberry, poison ivy, knotweed) and trees which flourish on the forest edge (sumac, poplar, black walnut) (DeRoo and Parker 1989; Parachini 1981:7-12). The soil type of this area is Oakville fine sand, a soil poorly suited for agriculture (United States Department of Agriculture 1987:17). It is unlikely that the inhabitants of Elam would have attempted to grow crops at this location.
Figure 1. Sites Mentioned in Text.
Figure 2. Map of Forest Types Adjacent to Elam Site.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Summary of Investigations

The Elam site was located during the Kalamazoo Basin Survey in 1977 by Dr. William Cremin of Western Michigan University. Dr. Elizabeth Garland subsequently directed excavations at the site by the Western Michigan University Archaeological Field School in 1978, 1983, 1985 and 1987. Faunal and botanical data recovered during the 1978 field seasons were the subject of two master's thesis projects (Barr 1979; Parachini 1981), and lithics from the 1978 and 1983 field seasons were analyzed in a W.M.U. Honors College paper (Campbell 1983). Preliminary botanical data from all field seasons were presented in a paper at the 1989 Midwest Archaeological Conference (DeRoo and Parker 1989).

Investigations have revealed the presence of two major Woodland components at the Elam site: a small Early Woodland component (Cogswell 1986; Garland 1986) and a much larger Late Woodland component. This study deals with the latter component.

The Late Woodland Component

Radiocarbon dates from this component range from 830 +/- 60 years: A.D. 1120 to 470 +/- 70 years: A.D. 1480. Both shell and grit tempered ceramics are represented here, exhibiting strong ties to Berrien Ware and Moccasin Bluff Ware as described for the Moccasin Bluff site (Bettarel and Smith 1973) and the Schwerdt site (Cremin 1980; Mc Allister 1980).

Late Woodland Features

A total of 81 cultural features has been assigned to the Late Woodland component at the Elam site. A feature typology was proposed by Kenneth Barr (1979)
for the features encountered during the 1978 excavations. The author has revised and updated this typology to include Late Woodland features excavated subsequent to 1978.

**Type A**

Type A features (N = 39) are deep, circular, round-bottomed roasting pits, measuring 100 to 246 cm in diameter and with depths (measured from top of feature) ranging from 65 to 120 cm. The basal zone is an area of *in situ* burning, containing much charcoal but sparse cultural material, and ringed by a lens of orange/red oxidized sand, indicating the presence of a hot fire. Carbonized tubers of the American lotus (*Nelumbo lutea*) are often recovered from these basal fuel zones. Overlying the basal fuel zone is a layer of fill which is more or less culturally sterile. The top of the feature consists of a large, dark brown or black soil unit rich in cultural debris and often containing abundant charcoal, representing a second (and occasionally a third) episode of *in situ* burning. The Type A pits are interpreted as sturgeon and/or tuber roasting pit facilities which were reused by the aboriginal inhabitants in a surface hearth and/or refuse pit context (DeRoo and Parker 1989). Two of the features selected for this study are classified as Type A pits.

**Type B**

Type B features (N = 8) are small, shallow pits containing very little lithic, ceramic or faunal data. Botanical remains (with the exception of wood charcoal) are also sparse. Their function is poorly understood. No features of this type were encountered during the 1987 field season and therefore a representative of this feature type was not included in this study.
Type C

Type C features (N = 22) were termed "shallow roasting pits." Their size in plan view is similar to the Type A pits but they are much shallower, ranging from 28 to 65 cm deep. They exhibit the same type of basal fuel zone and areas of oxidized sand as the Type A pits, but they generally lack the culturally and organically rich upper zone. They also tend to be more flat-bottomed than Type A features. Lotus tubers have also been recovered from the fuel zones of this pit type. It is unclear whether this type represents a different functional category from the Type A "deep" roasting pits. Four of the features chosen for this study are Type C pits.

Type D

This is a heterogenous category more or less artificially created to include all features (N = 5) lacking any evidence of in situ burning. They are classed simply as "pits." These features are rare at Elam, and none is included in this study.

Untyped

These features (N = 5) could not be placed in any of the above categories and are left "Untyped." None is included in this study.

Subsistence Data

No traces of domestic structures or rich midden layers could be detected at Elam. It is unlikely that the site was used as a permanent village or base camp. Still, the large number of pit features excavated by WMU personnel indicates that intensive food processing activities were being carried out by the site's inhabitants. The Late Woodland occupation was probably seasonal, brief and centered upon the procurement
and processing of certain riverine food sources.

Sturgeon bone is prominent among faunal remains of the Elam features, leading to the hypothesis that the major focus of the Late Woodland occupation was the capture of lake sturgeon during the late spring-early summer spawning runs.

The major food plant represented in the Elam flotation residues is the tuber of the American lotus. A total of 20.05 grams of tubers has been recovered from 13 features, mostly from the basal fuel zones of deep roasting pits, indicating primary usage of these features as tuber processing facilities. Ethnohistoric evidence indicates that lotus tubers were held in high esteem by the Native American inhabitants of the Great Lakes region (Parachini 1981:49; Smith 1933). It is possible that the tubers were considered of equal importance to the sturgeon as a food source. Some have suggested that the plant was introduced and/or cultivated in a number of locations in prehistoric times (Merrill 1954:162–63). Supporting this theory is the fact that Elam is now well outside the present-day range of American lotus.

Tubers fill with starch and are optimal for consumption in the spring and fall (Fernald and Kinsey 1958:200; Yarnell 1964:50). Thus, they could have been harvested at the same time as the lake sturgeon. Munson (1984:466) cites ethnohistoric evidence of the gathering of tubers through the ice during winter until the following spring, implying an almost continuous availability from autumn until spring.

Botanical characteristics and aboriginal usage of American lotus are detailed in Parachini (1981:49–57). After roasting or boiling, the tubers were sliced and dried for later use:

When the pieces are thoroughly dry and hard as wood, they put them into bags and keep them as long as they wished. If they boil their meat in a kettle, they also cook this root, which thus becomes soft and when they wish to eat it, it answers for bread with their meat. (Smith 1933:106, quoted in Parachini 1981:56–7)

It would seem that the major economic activities being conducted at Elam were the
processing of lotus tubers and sturgeon for future use, with relatively little on-site consumption. This visitation evidently occurred during the spring as Late Woodland populations begin to aggregate into larger groups after spending the winter in small bands dispersed into hunting camps. After a brief visit to Elam, the occupants apparently proceeded to their summer agricultural village, which was probably located in the St. Joseph River valley (Cremin 1983).

Additional botanical evidence suggests either a short revisitation or a longer occupation of the site through mid-to late-summer, and perhaps into early fall. Carbonized seeds of *Rubus* spp. (blackberry), *Rhus* spp. (sumac), *Vitis* spp. (grape), *Crataegus* spp. (hawthorn) and *Prunus* spp. (cherry) were noted in many of the re-used portions of the roasting pits (Deroo and Parker 1989), extending the seasonality of occupation at least until the end of summer.

Carbonized nutshell occurs in 25 features, but almost always in very small quantities (usually 0.1 gram or less per feature), suggesting incidental bits of forest litter becoming incorporated into the campfire, rather than the use of nuts as a food resource. An apparent exception is Feature 1, a Type A pit which seems to have been filled with camp refuse following its initial use as a roasting pit. One hundred and six pieces of carbonized black walnut shell (*Juglans nigra*) totalling 12.55 g was recovered, mostly from the uppermost zone of the feature (Parachini 1981:67). It is notable that this data was not recovered using the column technique. Being the first feature encountered at Elam, the entire contents of Feature 1 were taken for flotation, and in the laboratory a 25% split sample was analyzed. The nutshell in Feature 1 was associated with large quantities of sturgeon bone and several carbonized seeds (6 hawthorn, 1 blackberry, 1 *Polygonum* and 10 *Chenopodium*) indicating summer to early fall seasonality. The basal fuel zone of the feature contained small fragments of American lotus tubers. Thus, subsistence data indicate that the feature was utilized at
least intermittently by Late Woodland peoples from spring to early autumn. The nature of these later seasonal visitations is not well understood, but they seem to be transient and scattered episodes, perhaps related to aboriginal canoe travel on the Kalamazoo River (the site is still a popular boat landing today), while the major occupation was undoubtedly associated with the sturgeon spawning season (DeRoo and Parker 1989).

As noted earlier, no remains of cultivated plants have yet been found at the site. Three important factors militate against the presence of cultivated plant remains at Elam: the site's location on agriculturally marginal land, the limited duration of site occupation, and the hypothesized spring–early summer seasonality. However, given the evidence for occasional fall visits to the site, it is not implausible that some of these visits may have occurred subsequent to the harvest season, when cultivated plant products would have been available. Thus, it would not be particularly surprising to find carbonized residues of these plants in the Elam flotation samples.

**Previous Investigation**

Late Woodland populations in this region are believed to have been partially, if not primarily, dependent upon maize-beans-squash horticulture for their subsistence (Cleland 1976). Settlement patterns are hypothesized to have included a semi-permanent "village" or base camp occupied during the summer while crops were being planted and tended (Fitting 1969; Fitting and Cleland 1969). Following harvest, populations dispersed into winter hunting camps. With the arrival of spring, populations again aggregated at limited duration sites for the purpose of obtaining locally abundant resources as a dietary supplement to cultivated plant products (Cremin 1983). Examples of such sites would include maple sugar camps and sites such as Elam which were oriented towards the harvesting of migratory fish species during an annual spawn. The Schwerdt site, located 27.5 km downstream from Elam on the Kalamazoo River (Figure
1), is another site of the latter type. Schwerdt was excavated by the 1977 and 1979 Western Michigan University Archaeological Field Schools under the direction of Dr. William Cremin. Located on a high bluff above the river, Schwerdt is a single component Late Woodland site appearing very similar to Elam in ceramics, feature types and subsistence data (Cremin 1979, 1983; Higgins 1980; McAllister 1980). Sturgeon and American lotus tubers also occurred at Schwerdt, in deep roasting pits much like those present at Elam. Therefore the two sites appear to have operated in a similar capacity within the Late Woodland settlement/subsistence system. Schwerdt seems to be more narrowly focused than Elam on exploitation of spring spawning sturgeon, lacking evidence of continued occupation into summer and fall (Walz 1989).

To date, no sites have been found on the Kalamazoo River which seem to fit the description of a Late Woodland semi-permanent village, presumably representing the base camp of the residents of limited duration sites such as Elam and Schwerdt. Two sites in the neighboring St. Joseph River drainage, Moccasin Bluff (Bettarel and Smith 1973) and Wymer/West Knoll (Garland 1984b; Garland and Clark 1981) are thought to have functioned as this type of settlement (Cremin 1983). Charred cobs of maize were recovered from two features at Moccasin Bluff (Bettarel and Smith 1973), and a single carbonized cupule of maize was recovered at Wymer (Cremin 1983), lending support for the contention that these sites served as agricultural villages.

The importance of maize in the overall diet of Southwest Michigan's Late Woodland peoples remains problematic. It would have provided a major food source in the autumn, and undoubtably a sufficient quantity would have been stored for winter. However, during other seasons a wide variety of wild plant foods came available: greens and tubers in the spring, many types of berries in the summer, and fruits and nuts in autumn. Therefore, while cultivated plants may have been the staple plant foods in cold weather months, during the warmer months a wide variety of wild plant resources were
exploited. The Elam and Schwerdt sites provide a valuable glimpse of plant utilization during these seasons.

Schwerdt and Elam are the first two Late Woodland sites in southwest Michigan to be systematically sampled by flotation. Unfortunately, mostly because of their limited seasonality, they have not yielded information on the role of cultivated plants, particularly maize, in aboriginal subsistence. At Schwerdt, two Helianthus sp. (sunflower) achenes have been recovered, one from a midden sample and one from a feature, but their relatively small size is suggestive of a wild or weedy rather than cultivated variety (Gregory Walz, personal communication, 1991). Because of the somewhat longer seasonal duration implied by the Elam botanical assemblage, the recovery of carbonized domesticated plant remains in the flotation samples seems more likely. The total absence of domesticated plants observed so far from the Elam flotation data imply that the Late Woodland inhabitants may have been less dependent on these plants than previously believed. In the context of the present experiment, we were particularly interested in the possibility that cultivated plant remains may be present at Elam, but in such small amounts that they were being missed by the flotation column samples and unnoticed during excavation.
CHAPTER III

THE FLOTATION EXPERIMENT

Six Late Woodland features were selected for the experiment, two Type A and four Type C pits. They were chosen to represent the variability observed during the 1987 field season.

Field Methodology

Standard excavation procedures were employed. The feature was drawn in plan view and a center line established. The first half of the feature was excavated as a unit and put through a 1/4 inch screen. All cultural materials were retained, including any charred material that did not appear to be wood.

Following excavation of the first half of the feature, a profile was obtained. Soil zones were defined and given a Munsell (1975) soil color code. A 20 X 20 cm flotation column was then defined down the center of the profile, and 10 liters of feature fill removed from each zone. Each sample was placed in a plastic bag, marked "20 cm column sample," and assigned a lot number. If a minimum of 10 liters was not available for a particular zone within the column defined, the largest available sample was taken for that zone.

After taking the column sample, the remainder of the second half of the feature was taken as an additional flotation sample, divided by zone in the same manner as the 20 cm column. The samples were not put through screens but were placed directly into large plastic bags and given lot numbers separate from the column samples. These additional samples ranged from 8 to 98 liters depending on the size of the zone. If a
sample did not fit into a single plastic bag, it was placed in consecutive bags which were
labelled as such: 1 of 8, 2 of 8, etc., all being assigned to the same lot number.
Somewhat later, on a warm sunny day, the author and some field school students went
down the banks of the Kalamazoo River and water-separated the samples using a hand-
agitated tub.

Laboratory Methodology

In the laboratory, the samples were sorted and analyzed using standard
techniques. Geological sieves were used to expedite the sorting process. Fragments of
wood charcoal and bone over 850 microns in size were kept and quantified. All seeds,
tubers, nutshell fragments, microflakes and sherds were kept and quantified regardless
of size.

Wood charcoal was subsampled by selecting pieces at random from a sample
until a certain arbitrary number were identified to genus or species level. A series of
geological sieves was used to divide fragments into two size categories: 6.3 mm or
larger, and 3.35 mm - 6.2 mm. In general, equal numbers of fragments were selected
from each of these two categories. In this way it was hoped to avoid any size bias
against wood taxa which may have been used only in the form of small fragments (i.e.
as kindling) or which may be more liable to fragment with age (DeFant 1986:38).

Standard texts were used to aid in the identification of wood charcoal (Core.
Cote and Day 1979; Panshin and De Zeeuw 1970) and carbonized seeds (Martin and
Barkley 1961; Montgomery 1977). The author also made use of a type set of wood
charcoal compiled by David DeFant from Schwerdt site specimens and currently in the
possession of Dr. William Cremin; a type set of seed and nutshell specimens compiled
by Dr. William Cremin; Elam site seed, nutshell and tuber specimens from the 1978
field season previously identified by Kathryn (Parachini) Parker; and plant materials
from the U.S. 31 freeway project (Garland ed. 1984b) also identified by Kathryn Parachini (1981). Finally, several specimens were taken by the author to the Ethnobotany Laboratory at the University of Michigan in Ann Arbor, for comparison with items in their type set.

A 10 and 20X binocular microscope was used for identifications of wood charcoal, seeds, nutshell and tubers. This was adequate for all but certain unusual wood types which require examination of minute anatomical traits. Some of these unidentified wood types were taken to the Ethnobotany Laboratory in Ann Arbor for analysis under higher magnification, but the results were inconclusive. These unknown types comprise only a tiny fraction of the total wood charcoal assemblage for the six features selected for this experiment.
CHAPTER IV

RESULTS OF THE EXPERIMENT

In the course of this experiment 1042.5 liters of flotation samples were collected, yielding 1526 grams of charcoal residue, including 221 carbonized seeds, 2.10 grams of tubers and 1.80 grams of nutshell. No remains of cultivated plants were recovered. In this chapter the results are presented for each feature in turn, with the contents of the 20 cm column samples alone compared to the contents of the entire feature half. Tables and figures in this chapter present data from the features as a whole without breaking results down by zone, although discussion of botanical contents of individual feature zones is included where appropriate. Detailed listings by zone of botanical contents for both column samples and 50% samples are presented in Appendix 2.

Wood charcoal data from all features are presented at the end of this chapter.

Feature 84

Feature 84 was a large Type A roasting pit, 75 cm deep, with an estimated volume of 1.53 m³ (feature volume estimates appearing in this chapter are computed using formulae provided by Dr. William Cremin). It contained large quantities of charcoal, animal bone (sturgeon, deer, beaver, turtle), ceramic sherds and lithic debitage. Two lithic tools, one carbonized tuber of American lotus (*Nelumbo lutea*) and six fragments of carbonized acorn nutshell (*Quercus* spp.) were recovered during field excavation of the first half of the feature.

In profile, three distinct zones of in situ burning are visible (Figure 3; soil values presented in this thesis are from Munsell 1975). Basal Zone E contained large frag-
Figure 3. Profile of Feature 84.

ELAM (20AE195)

Feature 84 Profile

PLOW ZONE

ZONE: A - 5YR2.5/1 (black)
B - 10YR2/2 (very dark brown)
C - 10YR2/1 (black)
D - 10YR5/8 (yellowish brown)
E - 2.5Y2/0 (black)
F - 5YR5/8 (yellowish red)

Munsell Soil Values

Zone A

Zone B

Zone C

Zone D

Zone E

Zone F

OXIDIZED SAND

MIXED OXIDIZED SAND AND CHARCOAL

Flotation Column
ments of incompletely combusted logs and twigs in a greasy soil matrix. It is flanked by, and partially mottled with, a layer of oxidized sand (Zone F) which indicates presence of a hot fire. Zone D appears to be the redeposited fill which was later intruded as the pit was re-excavated for an apparent second use as a roasting pit (Zone C). Zone E also seems to have been partially intruded by this re-excavation. Zone C had a high concentration of charcoal, but lacked an associated lens of oxidized soil, possibly reflecting a different function and/or processing technique. Zone B is a second fill episode; the fact that it intrudes on Zone C suggests the latter zone may have been re-excavated (annually?). Zone A represents a third zone of in situ burning which is larger and more diffuse than the other two fuel zones, and also differs in botanical contents. Carbonized seeds (indicating mid- to late-summer seasonality) occurred almost exclusively in Zone A, while carbonized American lotus tubers (indicating spring seasonality) occurred in both Zones C and E. Nutshell occurred in Zones A, B and C. While the function of Zone E was apparently as a tuber roasting pit, the functions of Zones A and C are less obvious. Zone C contains both lotus tubers (like Zone E) and nutshell (like Zone A). Perhaps it represents use as a tuber roasting facility, like Zone E, with the nutshell representing contamination resulting from repeated excavation and backfilling. Zone A also seems to reflect repeated episodes of excavation, use and backfill. It probably represents multiple utilization as a shallow cooking pit and/or surface hearth.

Zones E and F were combined for the 50% sample. No flotation was taken from Zone D.

**Carbonized Seeds**

Table 1 compares taxa recovered from the column sample and the 50% sample. Seeds from both were heavily dominated by *Rubus* spp. (blackberry), which are

---

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
Table 1

Carbonized Seeds, Nutshell and Tubers from Feature 84:
20 cm Column Compared to 50 % Sample

<table>
<thead>
<tr>
<th>Taxa</th>
<th>20 cm Column</th>
<th>50 % Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEEDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>34</td>
<td>147</td>
</tr>
<tr>
<td>Galium spp. (cleavers/bedstraw)</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Rhus spp. (sumac)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Polygonum spp. (knotweed/smartweed)</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>Carpinus caroliniana</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>(Am. hornbeam)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fabaceae (bean family)</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td>Poaceae (grass family)</td>
<td>--</td>
<td>1</td>
</tr>
<tr>
<td><strong>NUTSHELL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juglans cinerea (butternut)</td>
<td>1/0.30 g</td>
<td>3/0.50 g</td>
</tr>
<tr>
<td>J. nigra (black walnut)</td>
<td>---</td>
<td>3/0.30 g</td>
</tr>
<tr>
<td>Quercus spp. (acorn)</td>
<td></td>
<td>3/0.10 g</td>
</tr>
<tr>
<td><strong>TUBERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nelumbo lutea (Amer. lotus)</td>
<td>---</td>
<td>1/1.30 g</td>
</tr>
</tbody>
</table>

unusually numerous in this feature. Blackberry seeds accounted for approximately 90% of the total seeds in both samples (Figure 4). *Galium* spp. (bedstraw/cleavers) and *Prunus* spp. (cherry) are the only other taxa which appear more than once; of the others, only sumac may have been important for subsistence. With the exception of...
blackberry, the quantity of seeds recovered is minuscule, especially considering the extremely large volume of the extra samples taken.

The expected and observed frequencies of blackberry, cherry and *Galium* seeds in the 50% sample were obtained by assuming that the density of seeds (in number per liter) in the column is representative of the density in the rest of the 50% sample. The remainder of the seed taxa present in Feature 84 were quantitatively too scarce to permit statistically valid statements. As shown in Figure 5, the density of blackberry seeds was much higher in the flotation column than in the rest of the nait-eature, resulting in a lower than expected number for the 50% sample. Cherry seeds show a similar pattern. *Galium*, on the other hand, comes close to its expected frequency in the 50% sample. Therefore, it is evident that the relative percentages of seed types are almost identical in both the column and 50% samples, with blackberry predominating in both. Also, the seed density of the three major seed types present in the feature is at least as high in the column sample as the 50% sample.

Figure 4. Percentages of Seed Taxa in Column Sample and 50% Sample of Feature 84.
Carbonized Nutshell

Nutshell is represented by a total of nine fragments weighing 0.90 g, representing three taxa. Column samples yielded only a single fragment of butternut (Juglans cinerea), while 50% samples yielded two additional fragments of butternut and three fragments each of black walnut (J. nigra) and acorn (Quercus spp.). Acorn was also represented by six small shell fragments recovered during excavation of the south half of the feature, which was not sampled by flotation. The low quantity of nutshell present in Feature 84 precludes any meaningful statistical comparison between the column sample and 50% sample.
Carbonized Tubers

Carbonized tubers of the American lotus recovered by flotation were represented by a single fragment weighing 1.3 g from the 50% sample. None was evident in the flotation columns, but a fragment was recovered by hand during excavation of the south half of the feature, which was not sampled by flotation.

Seasonality

The plant taxa represented in the flotation column sample range in season of availability from early June to early November (seasonality information included in this thesis taken from Billington 1943; Munson 1984; and Yarnell 1964. Seasonality charts presented in this chapter follow the format of Munson 1984). Additional taxa recovered in the 50% sample (black walnut, Polygonum and acorn) do not extend the seasonal range, but they do tend more heavily toward fall seasonality (Figure 6). Also, the additional occurrences of cherry pits and nutshell fragments in the 50% sample, although not numerous enough to be statistically significant, nevertheless provide important evidence for late summer to fall occupation. Evidence for later seasonal occupation comes primarily from Zone A.

Feature 85

Feature 85 is a small Type C roasting pit, 46 cm deep and with an estimated volume of 0.38 cubic meters (see Figure 7 for profile). Zone B is a fuel zone with an associated lens of oxidized sand (Zone C), but the amount of charcoal recovered was very low, especially in the column sample. Zones B and C were combined for the 50% sample. Zone A is the overlying fill zone.

Very few feature contents were noted with the exception of an almost whole
### Seasonal Availability

#### Flotation Column

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>A</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Calluna spp. (bedstraw/cleavers)</td>
<td>A</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Rhus spp. (sumac)</td>
<td>A</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Juglans cinerea (butternut)</td>
<td>A</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td>C</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

#### 50% Sample

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>A,B,C</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Rhus spp. (sumac)</td>
<td>A</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Juglans cinerea (butternut)</td>
<td>A</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>J. nigra (black walnut)</td>
<td>A,C</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Polygonum spp. (smartweed/knotweed)</td>
<td>B</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Quercus spp. (acorn)</td>
<td>C</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

000 = Season of availability  
XXX = Optimal harvesting period
shell-tempered pot. Botanical remains in particular were very sparse. No nutshell or tubers were recovered.

**Carbonized Seeds**

Carbonized seeds were absent from the flotation column sample and represented in the 50% sample by only four specimens (Table 2), of which only the blackberry seed and cherry pit fragment may be considered food plants, although the very low number precludes any definitive statements. All carbonized seeds except the poison ivy were
Table 2
Carbonized Seeds From Feature 85

<table>
<thead>
<tr>
<th>Taxa</th>
<th>20 cm Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>SEEDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubus spp. (blackberry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium spp. (cleavers/bedstraw)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxicodendron radicans (poison ivy)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

found in Zone A.

**Seasonality**

The plant taxa present in Feature 85 indicate a relatively tight seasonality, centering in July and August.

**Feature 86**

This is another small, shallow (40 cm deep) Type C pit with an estimated volume of 0.27 cubic meters (Figure 8). It is intruded on one side by Feature 92. Zone E is a fuel zone with a very weakly associated oxidized lens (Zone F). Zones C and D are fill zones. No column samples were taken from Zone D, and Zones C and D were combined for the 50% sample.

Unlike Feature 85, this pit yielded large amounts of faunal remains (beaver, deer, turtle and sturgeon) and moderate amounts of ceramic and lithic debris, but very few botanical remains.

Carbonized seeds and nutshell recovered from Feature 86 flotation samples all...
Figure 8. Profile of Feature 86.

came from Zones C and D, and are presented in Table 3.

Carbonized Seeds

All of the seed taxa except one are represented in the column sample. Two probable food plants, blackberry and Amelanchier sp. (juneberry/serviceberry), are present in the column sample only, and except for the cherry specimen, very little additional data was gained from taking the extra samples. Seed quantities are too low to permit any statistical comparisons.
Table 3
Carbonized Seeds and Nutshell From Feature 86

<table>
<thead>
<tr>
<th>Taxa</th>
<th>20 cm Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>SEEDS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium spp. (cleavers/bedstraw)</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td>Amelanchier spp. (juneberry/serviceberry)</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td>Fabaceae (bean family)</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td><strong>NUTSHELL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>1/0.10 g</td>
<td>1/0.10 g</td>
</tr>
<tr>
<td>Carva spp. (hickory)</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

**Carbonized Nutshell**

Carbonized nutshell consisted of two fragments, one black walnut shell present in the flotation column and one hickory nut fragment from the 50% sample. Although the presence of two species in the 50% sample implies human utilization, in this case the sample size is again too small to make a definitive statement.

**Seasonality**

As seen in Figure 9, the seasonality of the taxa represented in the column sample basically reflects that of the 50% sample, although the additional taxa yielded by the extra samples (cherry, hickory) weight the evidence in favor of a later (late summer-fall) occupation.
### Feature 86

#### Flotation Column

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amelanchier spp. (juneberry/serviceberry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium spp. (bedstraw/cleavers)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Seasonal Availability

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amelanchier spp. (juneberry/serviceberry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium spp. (bedstraw/cleavers)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carva spp. (hickory)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

50 % Sample

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amelanchier spp. (juneberry/serviceberry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium spp. (bedstraw/cleavers)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carva spp. (hickory)</td>
<td>C &amp; D</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**OOO** = Season of availability  
**XXX** = Optimal harvesting period
Figure 10. Profile of Feature 87.

Feature 87

This Type A feature, with a depth of 70 cm and estimated volume of 1.16 cubic meters (see profile, Figure 10), contained liberal amounts of animal bone (deer, sturgeon, box turtle), ceramics and lithic debitage, including several tools.

It is very similar to Feature 84 in general morphology, including the attribute of multiple zones of in situ burning; while Feature 84 had three, Feature 87 has two. Zone E is the basal fuel zone (with Zone D the associated oxidized lens); Zones B and C are fill zones differentiated by a sharp break in soil texture; and Zone A is a second fuel zone.
<table>
<thead>
<tr>
<th>Taxa</th>
<th>20 cm Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEEDS</strong></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Galium spp. (bedstraw/cleavers)</td>
<td>9</td>
<td>75.0</td>
</tr>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Fragaria virginiana (strawberry)</td>
<td>3</td>
<td>25.0</td>
</tr>
<tr>
<td>Solanum spp. (nightshade)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Chenopodium spp. (lamb's quarters/goosefoot)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Viola spp. (violet)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Toxicodendron radicans (poison ivy)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><strong>NUTSHELL</strong></td>
<td>n/wt</td>
<td></td>
</tr>
<tr>
<td>Quercus spp. (acorn)</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>

Carbonized plant remains, however, were quite scarce in this feature, making functional interpretation difficult. There were no carbonized tubers, only a trace of nutshell, and relatively few carbonized seeds. The nutshell and seeds are summarized in Table 4. Carbonized seeds were most numerous in Zone A but also occurred in Zones B and C.

Carbonized Seeds

Only two taxa were represented in the column sample. Five new taxa were represented in the additional samples, but of these five, only blackberry has the potential for being a food plant, and this interpretation is questionable due to the low quantity of seeds (in stark contrast to Feature 84, where human utilization of blackberry seems certain). Chenopodium spp. has been identified as a major seed crop plant at
sites in the Ohio, Mississippi and Illinois Valleys, but has rarely if ever been recovered from Michigan sites in sufficient quantities to suggest human utilization. The two carbonized seeds of *Chenopodium* from the 50% sample of Feature 87 are probably the result of natural seed rain dispersal.

Figure 11 shows the relative frequencies of seed taxa in both flotation column and 50% samples. In both cases *Galium* seeds predominate in approximately the same frequency. Taken alone, the column sample may give a misleading indication of the importance of strawberry. In any case, the sample is too small to make any valid statistical statements, even with the vast amount of soil matrix taken for flotation.

In Figure 12, the numbers of *Galium* and strawberry seeds in both column samples and 50% samples are compared to their expected frequencies. In both cases, it can be seen that the actual seed frequencies fall far below the expected frequencies. In the case of strawberry, in fact, all of the seeds observed came from the column sample; no additional seeds were recovered despite the taking of 218 additional liters of soil matrix for flotation.
Carbonized Nutshell

Carbonized nutshell was not noted in the column sample from Feature 87, and was represented in the 50% sample by two tiny fragments of *Quercus* spp. (acorn) weighing less than one tenth of one gram. Needless to say, this paltry sum is essentially irrelevant to subsistence analysis. The slivers of acorn are probably not related to aboriginal diet but are most likely incidental inclusions. In an oak forest region it would not be surprising to find pieces of acorn accidentally incorporated into the campfire and
preserved.

**Seasonality**

Figure 13 demonstrates that interpretations of seasonality are essentially the same using either data from the column sample only, or from the 50% sample. Both indicate spring to summer occupation. The addition of acorn in the 50% sample may be misleading with respect to seasonality, as acorns may lie on the ground over winter and may have been incorporated into the feature at almost any time of year. The presence of 14 carbonized buds (see Appendix 2) in the 50% sample (none was recovered in the flotation columns) is an indication of spring occupancy.

**Feature 93**

Feature 93 (Figure 14) is a small Type C pit similar to Features 85 and 86, with a depth of 35 cm and an estimated volume of 0.31 cubic meters. It was almost devoid of contents except for a large shell tempered rim sherd. No lithic tools or identifiable faunal remains were recovered.

Zone C is a very minimal fuel zone, with a faint oxidized sand zone (Zone D); both were combined for the 50% sample. Zones A and B are fill zones differentiated by slight differences in soil color; they were combined for the column as well as for the 50% samples.

**Carbonized Seeds, Tubers and Nutshell**

As shown in Table 5, botanical remains were very scarce in Feature 93, consisting of trace amounts of carbonized tubers and nutshell, and a single carbonized seed (a small pea-like structure, in two halves). The tuber specimens are apparently *Nelumbo lutea* (American lotus), although they were much smaller than most other...
Feature 87

**Flotation Column**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Fragaria virginiana</em> (strawberry)</td>
<td>A</td>
<td>---</td>
<td>O</td>
<td>XXX</td>
<td>O</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><em>Galium spp.</em> (bedstraw/cleavers)</td>
<td>A, B, C</td>
<td>---</td>
<td>----</td>
<td>---</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

**50% Sample**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Zone</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Fragaria virginiana</em> (strawberry)</td>
<td>A</td>
<td>---</td>
<td>O</td>
<td>XXX</td>
<td>O</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><em>Quercus spp.</em> (acorn)</td>
<td>A</td>
<td>---</td>
<td>----</td>
<td>---</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><em>Galium spp.</em> (bedstraw/cleavers)</td>
<td>A, B, C</td>
<td>---</td>
<td>----</td>
<td>---</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><em>Rubus spp.</em> (blackberry)</td>
<td>A, C</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><em>Chenopodium spp.</em> (lambs quarters/goosefoot)</td>
<td>A, C</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>---</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

---

OOO = Season of availability

XXX = Optimal harvesting period
tuber specimens collected from the site (cf. Feature 84).

The nutshell present may very well be the result of human utilization (the co-occurrence of at least two potential food plant taxa increases the likeliness that they were culturally deposited), although the extremely small quantity makes such speculation hazardous.

Carbonized tubers and nutshell were present in both Zones A/B and C/D: the lone seed occurred in C/D.
Table 5
Carbonized Seeds, Nutshell and Tubers From Feature 93

<table>
<thead>
<tr>
<th>Taxa</th>
<th>20 cm Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEEDS</td>
<td>n %</td>
<td>n %</td>
</tr>
<tr>
<td>Fabaceae (bean/legume family)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-- --</td>
<td>1 100.0</td>
</tr>
<tr>
<td>NUTSHELL</td>
<td>n/wt</td>
<td>n/wt</td>
</tr>
<tr>
<td>Quercus spp. (acorn)</td>
<td>2/0.05 g</td>
<td>2/0.05 g</td>
</tr>
<tr>
<td>Juglandaceae (walnut family)</td>
<td>---</td>
<td>4/0.10 g</td>
</tr>
<tr>
<td>Unidentified nutshell</td>
<td>---</td>
<td>4/0.10 g</td>
</tr>
<tr>
<td>TUBERS</td>
<td>n/wt</td>
<td>n/wt</td>
</tr>
<tr>
<td>Nelumbo lutea? (American lotus)</td>
<td>---</td>
<td>3/0.25 g</td>
</tr>
</tbody>
</table>

Seasonality

Very little information on seasonality was obtained from this feature. The nutshell implies fall seasonality (although the small quantity casts doubt on whether their presence was due to cultural factors), and the tubers could have been gathered either in the spring or fall.

Feature 98

Feature 98 (Figure 15), the final feature selected for this thesis project, is a Type C feature with a depth of 34 cm and an estimated volume of 0.81 cubic meters. It contained the base of a small side-notched point and some small shell-tempered body sherds. In morphology this feature is somewhat different from the other Type C
Figure 15. Profile of Feature 98.
features selected for this experiment, being much wider and very shallow, with a very minimal basal fuel zone (Zone C) and only the slightest hint of an oxidized sand zone. Numerous small carbonized twigs and fragments of bark (including pine bark) were found throughout Zones A and B (both in the column and 50% samples), which are fill zones differentiated by slight differences in soil color. These latter two zones were combined for both the column and 50% samples.

Carbonized seeds and nutshell recovered from Feature 98 flotation samples are shown in Table 6. Only two carbonized seeds were recovered (none from the column sample), but this feature had more carbonized nutshell than any in this study except Feature 84. Almost all nutshell was recovered from Zones A and B.

**Carbonized Nutshell**

Nutshell recovered from the column sample only is compared with expected and
observed recovery of nutshell from the 50% sample in Figure 16. In this case, the latter two figures are almost identical, indicating that the column sample adequately represented the contents of the entire 50% of the feature. However, only one taxon (hickory) was represented in the column sample, while two other taxa (black walnut, acorn) were observed in the extra samples taken. This is extremely significant evidence for human utilization of the autumn nut crop, which has important implications for our analysis of subsistence and seasonal occupation at the Elam site.
Seasonality

Seasonality of plant taxa recovered from both column and 50% flotation samples from Feature 98, although scanty, indicate, on average, a much later season of occupation than the other features selected for this experiment. This is due largely to the carbonized nutshell recovered.

Wood Charcoal (All Features Combined)

The composition of wood charcoal from each of the features included in this study is presented in Figure 17. Pie graphs depict the percentages of wood taxa present on both the column sample and 50% sample of each feature. The graphs also indicate habitat preferences of wood charcoal taxa.

As mentioned in Chapter II, there are two major forest types in the immediate vicinity of the Elam site (Figure 2) (Habitat information in this thesis taken from Cremin 1979 (quoted in DeFant 1986:Table 2), Kenoyer 1934, Otis 1931, Smith 1978 and Yarnell 1964). The first is the swamp/wetland forest association which exists in the floodplain of the Kalamazoo River. Wood charcoal taxa which have been identified at Elam and belong to this habitat include American elm (Ulmus americana), sycamore (Platanus occidentalis), ash (Fraxinus spp.), yellow birch (Betula lutea) and soft maple (Acer spp.). The oak–pine woodland is characterized by red and white oaks (Quercus alba. Q. macrocarpa. Q. rubra. Q. velutina) and white pine (Pinus strobus). A third forest association, beech–maple, is dominant throughout much of Michigan although not in the vicinity of the Elam site. Common trees in this forest include beech (Fagus grandifolia), hard maple (Acer spp.), tulip tree (Liriodendron tulipifera) and basswood (Tilia americana), taxa which are extremely rare to absent in the Elam site wood charcoal assemblage. Certain other hardwood taxa present at Elam may occur either
Figure 17. Wood Charcoal Composition (in Percent by Weight) of Column Samples and 50% Samples of Features 84, 85, 86, 87, 93 and 98.
with beech-maple or oak-pine associations, but in this case their presence almost certainly indicates connection with the latter plant community. They include hickory (Carya spp.), black walnut/butternut (Juglans spp.), hop hornbeam (Ostrya virginiana) and chestnut (Castanea dentata). Unknown wood types are assigned to the category of "unidentified."

As can be seen in Figure 17, each feature varied in the degree to which the column represented the 50% sample in terms of presence and relative percentages of wood taxa. A similar pattern is observed with respect to habitat types. In the case of the Type C features, particularly Features 85 and 93, random error resulting from small sample size probably contributed to the greater variability observed. The other features, however, seem to have been well represented by the column samples.
CHAPTER V

DISCUSSION AND CONCLUSIONS

Now that we have completed the experiment and seen the results for a group of six features, what can be generalized about the effectiveness of the flotation column as a means of obtaining an adequate, representative sample of the botanical remains from a cultural feature? It can be seen from the preceding examples that the column samples were not uniformly effective in all situations, although densities of all types of archaeobotanical data were higher in the column sample than in the 50% sample (Table 7). The reason for this consistently higher density of data may be that the taking of the entire feature fill inevitably results in "dilution" of the data, since the edge of the feature mottles with surrounding subsoil. Since there is no clear break, in order to insure complete data recovery excavators must dig until reaching completely sterile subsoil. Even taking this into account, however, it is obvious that all types of archaeobotanical data were well represented in the column samples.

Carbonized Seeds

Table 8 provides a detailed list of carbonized seeds as they occur in column and 50% samples. Blackberry is undoubtedly the most significant taxon in terms of subsistence, and it was well represented in the column samples. Other taxa whose presence is probably related to subsistence include cherry, strawberry and juneberry/serviceberry. Sumac and Fabaceae (bean/legume family) may also have contributed to the diet. All of these taxa were represented in the column samples; in fact, in two cases (strawberry and juneberry/serviceberry), seeds were present in the
Table 7
Comparisons of Archaeobotanical Data

<table>
<thead>
<tr>
<th>Archaeobotanical Indicator</th>
<th>Column Samples</th>
<th>50% Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood Charcoal (g/liter)</td>
<td>1.60</td>
<td>1.46</td>
</tr>
<tr>
<td>Seeds (no./liter)</td>
<td>0.38</td>
<td>0.21</td>
</tr>
<tr>
<td>Nutshell (g/10 liters)</td>
<td>0.04</td>
<td>0.02</td>
</tr>
<tr>
<td><em>Nelumbo lutea</em> tuber (g/10 liters)</td>
<td>0.11</td>
<td>0.05</td>
</tr>
</tbody>
</table>

flotation column but not in the rest of the 50% sample. Perhaps this is coincidental, but it suggests that even in cases of very sparse carbonized seed remains, the column method may have a fairly high probability of recovering scarce taxa.

Two taxa in particular deserve additional comment: What is the significance of the additional *Galium* seeds and cherry pits recovered from the 50% samples? The additional cherry pits in the 50% samples (mostly of Feature 84) provide additional evidence of late summer to early fall occupation at Elam. The seeds recovered at Elam may be of *P. virginiana* (chokecherry), *P. pennsylvanica* (pin cherry) or *P. serotina* (black cherry). Pin cherry or chokecherry would be small shrubs growing in a thicket near the Elam site or on the edge of the oak–pine woodland; the berries would ripen in August. Black cherry would have been a component of the oak–pine woodland itself; being intolerant of shade, it too would tend to occur in more open woods or on the forest edge. Its berries would be available in September.

The single cherry pit recovered from the flotation column samples was simply
Table 8

Carbonized Seeds, Nutshell and Tubers from All Features Combined

<table>
<thead>
<tr>
<th>Taxa</th>
<th>20 cm Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEEDS</strong></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Rubus spp. (blackberry)</td>
<td>35</td>
<td>66.0</td>
</tr>
<tr>
<td>Galium spp. (bedstraw/cleavers)</td>
<td>11</td>
<td>20.7</td>
</tr>
<tr>
<td>Prunus spp. (cherry)</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Fabaceae (bean/legume family)</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Fragaria virginiana (strawberry)</td>
<td>3</td>
<td>5.6</td>
</tr>
<tr>
<td>Solanum spp. (nightshade)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Chenopodium spp. (goosefoot)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Rhus spp. (sumac)</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Poison ivy (Toxicodendron radicans)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Amelanchier spp. (juneberry/serviceberry/shadbush)</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Carpinus caroliniana (Amer. hornbeam)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Polygonum spp. (knotweed)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Viola spp. (violet)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Poaceae (grass family)</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>TOTAL</td>
<td>53</td>
<td>100</td>
</tr>
</tbody>
</table>

**CARBONIZED NUTSHELL**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>n/wt</th>
<th>n/wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juglans cinerea (butternut)</td>
<td>1/0.30 g</td>
<td>3/0.50 g</td>
</tr>
<tr>
<td>J. nigra (black walnut)</td>
<td>1/0.10 g</td>
<td>5/0.50 g</td>
</tr>
<tr>
<td>Carya spp. (hickory)</td>
<td>6/0.10 g</td>
<td>11/0.20 g</td>
</tr>
<tr>
<td>Juglandaceae (walnut family)</td>
<td>---</td>
<td>11/0.15 g</td>
</tr>
<tr>
<td>Quercus spp. (acorn)</td>
<td>---</td>
<td>37/0.35 g</td>
</tr>
<tr>
<td>Unidentified nutshell</td>
<td>---</td>
<td>4/0.10 g</td>
</tr>
<tr>
<td>TOTAL</td>
<td>8/0.50 g</td>
<td>67/1.80 g</td>
</tr>
</tbody>
</table>

**CARBONIZED TUBERS**

<table>
<thead>
<tr>
<th>Taxa</th>
<th>n/wt</th>
<th>n/wt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelumbo lutea (American lotus)</td>
<td>---</td>
<td>4/1.55 g</td>
</tr>
</tbody>
</table>
not sufficient to draw serious attention to the possibility that the aboriginal inhabitants of Elam were exploiting this resource on a regular basis. The seven seeds recovered from the 50% samples, however, especially the 5 from Feature 84, present a much better argument for a later seasonal occupation at the Elam site. In this case the seeds were simply too rare and too scattered throughout the feature fill to have been adequately recovered using the column method.

*Galium* constituted the second most abundant seed taxon in this experiment. Bedstraw or cleavers is a small weedy plant which grows in a variety of situations, from a forested habitat to open fields. Its seeds "cleave" to humans and animals which spread the plants into new areas. It is in this way that the carbonized seeds probably were deposited in the cultural features. Evidence from this experiment, however, indicates the possibility of aboriginal human utilization of this plant resource at Elam.

Concentrations of *Galium* seeds occur in Features 84 and 87. The number of seeds recovered through the flotation columns is low enough that their presence may readily be explained away as incidental inclusion in the feature fill through seed rain dispersal. However, the larger number of seeds from the 50% samples, combined with two other lines of evidence, hint at the possibility that the presence of these seeds may be an artifact of human use.

First of all, *Galium* seeds have not been recovered at Elam in an uncarbonized state. Presumably, if their presence in a carbonized form is due to natural seed dispersal mechanisms then these same mechanisms should result in the presence of uncarbonized seeds as well. The Elam site even today is located on open ground where these plants would thrive. Other weedy opportunistic plants such as *Polygonum*, *Chenopodium*, pokeweed, nightshade, blackberry and poison ivy have been found at Elam both in a carbonized and uncarbonized state.

Secondly, the presence of *Galium* at Elam is ubiquitous. It was present in all
three of the flotation column samples which yielded carbonized seeds, and in five of the six 50% samples. Only Feature 93, which was practically empty, lacked Galium. Overall at Elam, 18 out of 48 Late Woodland features analyzed contained carbonized Galium (DeRoo and Parker 1989). Only blackberry was more ubiquitous. Galium seeds are commonly recovered from other sites in the Midwest as well (Lopinot 1982:780).

The evidence for the human utilization of Galium at Elam is slim, but it is a real possibility. Although there is no recorded use of this plant as food, it is reported that the seeds were roasted by the early European settlers as a substitute for coffee (Fernald and Kinsey 1958, quoted in Lopinot 1982:780). Yarnell (1964:160–61, 174) lists medicinal uses for Galium aparine, G. tinctorium, G. triflorum, G. concinnum and G. trifidum. The "whole plant" is evidently used (Smith 1928:244; 1932:386–7) in an infusion to produce a medicinal beverage. This usage would not necessarily include the seeds unless the plant was used at the reproductive phase of its growth cycle, which would be mid-summer. Thus, if the Galium seeds recovered at Elam are indeed an artifact of human utilization, it is unclear by what means they were incorporated in feature fill.

In summary, the column samples generally represented the contents of the features quite well. In only two cases (Galium and cherry) did the extra samples provide us with additional interpretive data which would otherwise have been missed, but within the broader context of subsistence and seasonality at Elam these are relatively minor issues.

Carbonized Nutshell

Flotation samples analyzed for this experiment yielded only 1.80 g of carbonized nutshell altogether, of which 0.50 g came from the column samples (Table 8).

The extra data provided by the 50% sample were useful in determining fall
seasonality at Elam. These extra specimens greatly improved the likelihood of a fall occupation by providing additional counts and weights and by revealing the presence of additional taxa in the same feature, increasing the possibility of human utilization of nut resources.

Because of the very low density of nutshell in all features examined for this thesis, it was difficult to interpret the significance of data obtained through the column sample alone. For example, the column sample for Feature 86 contained a single scrap of black walnut shell. The rest of the 50% sample added only a tiny fragment of hickory nut shell to this total, which is still ambiguous evidence for human utilization, especially when it is taken into consideration that an entire half-feature has been analyzed. In contrast, the column sample of Feature 84 produced only a single piece of butternut shell, but the remainder of the 50% sample yielded fragments of black walnut and acorn along with more butternut. Thus, we can make a much better evaluation of the potential for subsistence usage when the additional data of the 50% sample is taken into account.

Carbonized Tubers

Carbonized tubers are not commonly preserved in the archaeological record (Ford 1979; Yarnell 1982). Due to their fleshy quality, they are not likely to survive the process of carbonization. The carbonized tubers of the American lotus (*Nelumbo lutea*), which represent the major plant resource utilized by the Late Woodland inhabitants of the Elam site, were only preserved due to the unique circumstances of the low draught, slow cooking technique applied in the deep roasting pits (Parachini 1981:53–57).

The amounts of carbonized tubers of American lotus identified from both the column and 50% samples are included in Table 8.
It must be noted that American lotus tubers may also be recovered through excavation, especially if field workers are instructed to watch for them, as the fragments are generally large enough to be identified in the screen. For example, during the 1978 field season, tubers were recovered from six features; in three features by flotation and excavation, and in the other three by flotation only (Parachini 1981:Table 5). Only very small tubers of American lotus should elude field workers, and these will probably be too small for positive identification, as was the specimen from Feature 93.

However, this statement may not apply to tubers of other species. For example, tubers and bulbs of toothwort (Dentaria spp.), wild leek (Allium tricoecum), spring beauty (Claytonia virginica) or groundnut (Apios americana) may be too small for reliable recovery by excavation alone. So far, three other species of tubers besides American lotus have been noted in flotation samples from Elam, including a probable spring beauty tuber (identified by Kathryn Parker) from Feature 81. Of the six features included in this study, however, no other species of tubers were noted despite the taking of the entire feature halves, indicating either that other species were relatively unimportant in Late Woodland subsistence, or that circumstances simply mitigate against their inclusion in the archaeological record.

Cultivated Plants

Despite the taking of extremely large volumes of flotation samples for this thesis project, no remains of cultivated plants were noted in the charcoal residues. Three of the Fabaceae (bean/legume family) seeds, two from Feature 86 and one from Feature 84, at first appeared to be small maize kernels from the tip of an ear. However, consultation with several expert archaeobotanists produced agreement that they were indeed legumes. Therefore, although it seems likely that the Late Woodland aboriginal inhabitants of the Kalamazoo Valley depended on horticulture for a part of their
subsistence, no site from this area has yet produced the remains of cultivated plants.

Wood Charcoal

Wood charcoal was analyzed with two questions in mind: which taxa are present, and what are their relative proportions? Presence of taxa contributes information towards the reconstruction of the aboriginal environment. As we have seen, wood charcoal taxa present in both column and 50% samples closely corresponds to the current vegetational patterns in the site vicinity. Although there were seven taxa present in the 50% samples which did not occur in the column samples, all of these seven combined did not equal even one percent of the total wood charcoal by weight, and consisted mostly of unidentified types.

Relative proportion of wood taxa may be an indicator of aboriginal forest composition, especially if one accepts the "firewood indifference hypothesis" as put forth by Asch & Asch (1972), which assumes that in most cases the nearest available firewood will be exploited, regardless of species.

However, David DeFant, in his analysis of the Schwerdt wood charcoal assemblage (1986), has demonstrated that cultural selection for certain wood taxa may be recognized in the archaeological record. Basal fuel zones of the Schwerdt roasting pits yielded a much larger proportion of oak wood charcoal than other contexts sampled, leading to the conclusion that oak, because of its excellent coaling properties, was deliberately selected for use in this setting.

Figure 18 illustrates the overall percentages of wood charcoal by taxa and habitat type for the six features in this study. The relative compositions are almost identical in each case. The major exception is the significant under-representation of hickory in the column samples when compared to the 50% samples. It is interesting that while hickory is a major component of the wood charcoal assemblage in two of the
Figure 18. Wood Charcoal Composition (in Percent by Weight) of Column Samples and 50% Samples of all Features Combined.

six features studied for this thesis (Features 84 and 98), in both cases the taxon was greatly under-represented in the flotation column samples. Was this simply a coincidence, or a real structural phenomenon representing perhaps a cultural practice? As DeFant (1986) has demonstrated a cultural preference for oak wood in the basal fuel zones of roasting pits at the Schwerdt site, could the absence of hickory in the column samples also have been related to cultural practices (conscious or unconscious) in ways yet unknown? Figure 18 also illustrates a seemingly systematic over-representation of oak in the column samples. Perhaps a relatively slow-burning wood with excellent coaling properties (such as oak) would be preferred at the center of the fire where the
column is taken, while hickory wood (which provides flavor) would be placed nearer the edge, where it would be easier to “smoke” food. It is interesting to note that almost none of the hickory wood from Feature 84 came from the basal fuel zone, but rather from the upper zones. The practice of smoking food would likely be associated with a surface fire. Likewise, Feature 98, the other feature which yielded significant proportions of hickory, was a very shallow pit which was probably used in a surface context.

While all this is of course speculation, it may be significant to note that hickory wood is very rarely found in the Elam site wood charcoal residues. It was not encountered by Parachini (1981) in her analysis of flotation data from features excavated during the 1978 field season, and in a later study taking into account data from subsequent field seasons, it comprised only one percent of a very large sample in which over 2,000 pieces were analyzed (DeRoo and Parker 1989). Perhaps this scarcity of hickory wood is due in part to the use of the column method to sample features for flotation at the Elam site.

Conclusions

Overall, the column sampling method produced a very satisfactory, representative sample from the six features included in this analysis. Densities of wood charcoal, seeds, nutshell and tubers were found to be higher in the column samples than in the remainder of the features. However, it was also found that certain classes of archaeobotanical data (nutshell, cherry pits) were too sparse and diffuse to be recovered by the column samples in adequate quantities to evaluate cultural utilization. Although, statistically speaking, these items were adequately sampled by the column method, the additional quantities gained through subjecting the entire half feature to flotation significantly improved interpretive value. Cultivated plant remains are evidently even
more rare, if indeed they are present at Elam.

Other flotation sampling strategies besides the column sample are available and currently in use among archaeologists. One of them is the "pinch" method as defined by Pearsall (1989), where soil is taken from throughout a stratigraphic unit rather than just the center. It would seem that this method, when applied to features which exhibit in situ burning (such as the Elam roasting pits), should be applied judgmentally, selecting for those areas of soil with the most charcoal. From the perspective of wood charcoal, it seems desirable to sample for wood charcoal from throughout a zone, rather than only from the center, to get a closer approximation of the actual proportions of taxa present. This would have eliminated the bias against hickory wood observed in Features 84 and 98. Hand-picked samples collected by excavators in the field may help the situation somewhat, but these have the inevitable result of selecting for larger pieces, causing an under-representation of those taxa which tend to fragment more with age (DeFaint 1986:39). Clearly, flotation samples are the most desirable way to obtain wood charcoal data.

Since this experiment has shown that since features are generally well-represented by the column sample, it may be appropriate in some situations to retain the column and take additional pinch samples as needed from throughout the feature to eliminate distributional bias. Toll (1988) has demonstrated how flotation samples may be more quickly processed by "scanning" rather than a full sorting procedure. Use of her technique would permit the processing of additional and/or larger flotation samples without a corresponding increase in laboratory man-hours. Thus, archaeobotanical constituents which are present and interpretively significant but scattered diffusely throughout a feature may be more effectively sampled.

This need not be done for all features. For example, in our current study only Feature 84 really warranted to be additionally sampled. Elam has very few cultural
features that yield large or even moderate quantities of archaeobotanical data; many, such as Features 85, 86 and 93 in the present study, are largely empty. It can often be determined in the field whether it would be profitable to take additional samples from a feature. Rich zones of charcoal and larger pieces of food residues which can be identified in the screen signal such a feature. For example, during excavation of the south half (which was not subjected to flotation) of Feature 84, a carbonized American lotus tuber and six fragments of carbonized acorn shell were recovered. Such a feature, rich in botanical remains and providing evidence of occupation from spring to autumn, will contain the type of data we are interested in regarding seasonality and subsistence at Elam. While it is important to collect more or less standard amounts of soil from each context to ensure comparability of data within and between sites, for the purpose of specific problem orientations it may be of value to take additional samples from selected proveniences for the purpose of collecting certain classes of archaeobotanical data which may be too differentially distributed in feature fills for adequate recovery using standard-sized samples.

Also, it may be advantageous to differentially sample a feature by zones. In the case of Elam, charcoal–rich fuel zones might be treated differently from fill zones. Dr. William Cremin (personal communication) has sampled cultural features at other southwest Michigan sites by using a column for fill zones, while using the pinch method for fuel zones.

In conclusion, the methodology of taking flotation samples is a subject that has only recently begun to attract attention but is potentially of major importance from the standpoint of overall excavation strategy. The flotation column method allows a standardized sample to be taken from a large number of cultural features, and has been shown by this study to adequately represent the contents of the entire feature. However, flexibility may be instrumental in specific instances, such as cases of very low
densities of archaeobotanical materials. It is hoped that the data from the Elam site will
be of interest and utility to field workers engaged in excavations at similar sites.
Appendix A

Contents of Flotation Samples
<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>LITRES</th>
<th>WOOD CHARCOAL (g)</th>
<th>CHARCOAL g/LITRE</th>
<th>BONE</th>
<th>FLAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 84 Zone A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>106</td>
<td>308.3</td>
<td>2.91</td>
<td>13.8</td>
<td>28.3</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>31.8</td>
<td>3.18</td>
<td>8.7</td>
<td>2.3</td>
</tr>
<tr>
<td>F 84 Zone B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>84</td>
<td>197.5</td>
<td>2.35</td>
<td>7.5</td>
<td>11.8</td>
</tr>
<tr>
<td>Column Sample</td>
<td>8</td>
<td>25.2</td>
<td>3.15</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>F 84 Zone C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>86</td>
<td>315.0</td>
<td>3.66</td>
<td>8.1</td>
<td>6.4</td>
</tr>
<tr>
<td>Column Sample</td>
<td>7</td>
<td>31.2</td>
<td>4.46</td>
<td>0.8</td>
<td>0.1</td>
</tr>
<tr>
<td>F 84 Zone E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>63</td>
<td>208.4</td>
<td>3.31</td>
<td>1.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>22.9</td>
<td>2.29</td>
<td>&lt;0.1</td>
<td>--</td>
</tr>
<tr>
<td>F 85 Zone A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>70</td>
<td>10.6</td>
<td>0.15</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>Column Sample</td>
<td>7</td>
<td>0.9</td>
<td>0.13</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>F 85 Zone B &amp; C</td>
<td>70</td>
<td>16.5</td>
<td>0.28</td>
<td>3.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>4.3</td>
<td>0.43</td>
<td>0.7</td>
<td>--</td>
</tr>
<tr>
<td>F 86 Zone C &amp; D</td>
<td>108.5</td>
<td>102.3</td>
<td>0.94</td>
<td>26.3</td>
<td>10.7</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>21.4</td>
<td>2.42</td>
<td>2.8</td>
<td>2.1</td>
</tr>
<tr>
<td>F 86 Zone E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>16</td>
<td>48.3</td>
<td>3.00</td>
<td>0.5</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Column Sample</td>
<td>4</td>
<td>10.1</td>
<td>2.53</td>
<td>&lt;0.1</td>
<td>--</td>
</tr>
<tr>
<td>F 87 Zone A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>88</td>
<td>71.3</td>
<td>0.81</td>
<td>26.6</td>
<td>29.4</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>14.0</td>
<td>1.40</td>
<td>4.7</td>
<td>4.9</td>
</tr>
<tr>
<td>F 87 Zone B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>46</td>
<td>21.4</td>
<td>0.47</td>
<td>6.4</td>
<td>12.2</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>5.3</td>
<td>0.53</td>
<td>1.4</td>
<td>2.1</td>
</tr>
<tr>
<td>F 87 Zone C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 % Sample</td>
<td>86</td>
<td>48.0</td>
<td>0.56</td>
<td>3.3</td>
<td>9.7</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>10.1</td>
<td>1.01</td>
<td>0.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>LITRES</th>
<th>WOOD CHARCOAL (g)</th>
<th>CHARCOAL g/LITRE</th>
<th>BONE</th>
<th>FLAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 87 Zone E</td>
<td>38</td>
<td>97.9</td>
<td>2.58</td>
<td>1.3 g</td>
<td>0.7 g</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>27.2</td>
<td>2.72</td>
<td>0.8 g</td>
<td>0.3 g</td>
</tr>
<tr>
<td>F 93 Zone A &amp; B</td>
<td>48</td>
<td>24.6</td>
<td>0.51</td>
<td>0.1 g</td>
<td>0.2 g</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>5.9</td>
<td>0.59</td>
<td>0.1 g</td>
<td>0.1 g</td>
</tr>
<tr>
<td>F 93 Zone C &amp; D</td>
<td>36</td>
<td>12.1</td>
<td>0.34</td>
<td>0.2 g</td>
<td>&lt;0.1 g</td>
</tr>
<tr>
<td>Column Sample</td>
<td>8</td>
<td>2.1</td>
<td>0.26</td>
<td>&lt;0.1 g</td>
<td>&lt;0.1 g</td>
</tr>
<tr>
<td>F 98 Zone A &amp; B</td>
<td>84</td>
<td>30.8</td>
<td>0.37</td>
<td>1.0 g</td>
<td>1.9 g</td>
</tr>
<tr>
<td>Column Sample</td>
<td>10</td>
<td>6.1</td>
<td>0.61</td>
<td>0.2 g</td>
<td>0.2 g</td>
</tr>
<tr>
<td>F 98 Zone C</td>
<td>13</td>
<td>9.1</td>
<td>0.70</td>
<td>0.1 g</td>
<td>&lt;0.1 g</td>
</tr>
<tr>
<td>Column Sample</td>
<td>4</td>
<td>2.0</td>
<td>0.50</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>GRAND TOTAL-</td>
<td>1042.5</td>
<td>1522.1</td>
<td>1.46</td>
<td>100.7 g</td>
<td>119.0 g</td>
</tr>
<tr>
<td>Column Samples</td>
<td>138</td>
<td>220.5</td>
<td>1.60</td>
<td>22.4 g</td>
<td>15.0 g</td>
</tr>
</tbody>
</table>
Appendix B

Detailed Comparison of Material Collected From Flotation Column Samples and 50 % Samples of Features
### Feature 84

#### Zone A

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal</strong> (Weight and (count) %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Carva</em> sp. (hickory)</td>
<td>7 (7)</td>
<td>25 (23)</td>
</tr>
<tr>
<td><em>Ulmus americana</em> (Amer. elm)</td>
<td>43 (13)</td>
<td>27 (11)</td>
</tr>
<tr>
<td><em>Fraxinus</em> sp. (ash)</td>
<td>27 (27)</td>
<td>24 (21)</td>
</tr>
<tr>
<td><em>Quercus</em> sp. (total oak)</td>
<td>19 (33)</td>
<td>18 (26)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>14 (17)</td>
<td>6 (8)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>1 (7)</td>
<td>5 (6)</td>
</tr>
<tr>
<td><em>Pinus strobus</em> (white pine)</td>
<td>1 (10)</td>
<td>4 (11)</td>
</tr>
<tr>
<td><em>Juglans</em> sp. (walnut/butternut)</td>
<td>---</td>
<td>1 (2)</td>
</tr>
<tr>
<td><em>Platanus occidentalis</em> (sycamore)</td>
<td>1 (3)</td>
<td>&lt;1 (&lt;1)</td>
</tr>
<tr>
<td><em>Acer</em> sp. (soft maple group)</td>
<td>1 (3)</td>
<td>&lt;1 (&lt;1)</td>
</tr>
<tr>
<td><em>Betula</em> sp. (birch)</td>
<td>1 (3)</td>
<td>&lt;1 (&lt;1)</td>
</tr>
<tr>
<td><em>Castanea dentata</em> (Amer. chestnut)</td>
<td>---</td>
<td>&lt;1 (&lt;1)</td>
</tr>
<tr>
<td>Diffuse porous Type I</td>
<td>---</td>
<td>&lt;1 (&lt;1)</td>
</tr>
<tr>
<td>(buckthorn/Rhamnus cathartica?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Peduncles (Count)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Bark (Count/weight) (inc. pine bark)</td>
<td>11/0.80 g</td>
<td>125/1.90 g</td>
</tr>
</tbody>
</table>

#### Carbonized Nutshell (Count/weight)

| *Juglans cinerea* (butternut) | 1/0.30 g | 3/0.50 g |
| *J. nigra* (black walnut) | --- | 1/0.10 g |

#### Carbonized Seeds (count)

| *Rubus* sp. (blackberry) | 34 | 143 |
| *Rhus* sp. (sumac) | 1 | 1 |
| *Galium* sp. (bedstraw/cleavers) | 1 | 11 |
| *Prunus* sp. (cherry) | --- | 3 |
| Poaceae (grass family) | --- | 1 |

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
<table>
<thead>
<tr>
<th>TYPE OF MATERIAL</th>
<th>COLUMN</th>
<th>50 % Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td>(40 pc.)</td>
<td>(140 pc.)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>28 (35)</td>
<td>40 (29)</td>
</tr>
<tr>
<td>Carya sp. (hickory)</td>
<td>5 (10)</td>
<td>22 (21)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>65 (53)</td>
<td>28 (33)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>45 (38)</td>
<td>16 (16)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>14 (13)</td>
<td>5 (9)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>1 (3)</td>
<td>8 (16)</td>
</tr>
<tr>
<td>Ostrya virginiana (hophornbeam)</td>
<td>---</td>
<td>2 (1)</td>
</tr>
<tr>
<td>Acer sp. (soft maple group)</td>
<td>---</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Twigs (count)</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Buds (count)</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

**CARBONIZED NUTSHELL**

| Quercus sp. (acorn)                    | ---          | 2/0.05 g    |

**CARBONIZED SEEDS (Count)**

| Rubus sp. (blackberry)                 | ---          | 1           |
| Polygonum sp. (knotweed/smartweed)     | ---          | 1           |
| Carpinus caroliniana (Amer. hornbeam)  | ---          | 1           |
### Feature B4 (cont.)

**Zone C**

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal (Weight and (count) %)</strong></td>
<td>(41 pc.)</td>
<td>(190 pc.)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>44 (61)</td>
<td>38 (46)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>34 (44)</td>
<td>17 (16)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>8 (7)</td>
<td>16 (19)</td>
</tr>
<tr>
<td>Carya sp. (hickory)</td>
<td>8 (5)</td>
<td>34 (18)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>38 (20)</td>
<td>15 (14)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>9 (12)</td>
<td>12 (21)</td>
</tr>
<tr>
<td>Ulmus americana (Amer. elm)</td>
<td>1 (2)</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Ostrya virginiana (hophornbeam) (twig)</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

- Bark (Count/weight) | 17/1.00 g | 98/1.90 g |
- Resinous wood (Count) | --- | 3 |
- Peduncles (Count) | --- | 10 |
- Twigs (Count/weight) | 39/2.80 g | 139/7.10 g |

(includes small twigs of maple and larger sticks of oak)

**Carbonized Nuts Hull (Count/weight)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Count/weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>---</td>
</tr>
<tr>
<td>Quercus sp. (acorn)</td>
<td>---</td>
</tr>
<tr>
<td>Unidentified nutmeat</td>
<td>1/0.10 g</td>
</tr>
</tbody>
</table>

**Carbonized Tubers (Count/weight)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Count/weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelumbo lutea (American lotus)</td>
<td>---</td>
</tr>
</tbody>
</table>

**Carbonized Seeds (Count)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus sp. (blackberry)</td>
<td>---</td>
</tr>
<tr>
<td>Galium sp. (bedstraw/cleavers)</td>
<td>---</td>
</tr>
<tr>
<td>Prunus sp. (cherry)</td>
<td>1</td>
</tr>
<tr>
<td>Leguminosae (bean family)</td>
<td>---</td>
</tr>
<tr>
<td>TYPE OF MATERIAL</td>
<td>COLUMN</td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
</tr>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td>(20 pc.)</td>
</tr>
<tr>
<td><em>Quercus</em> sp. (total oak)</td>
<td>98 (85)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>89 (60)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>---</td>
</tr>
<tr>
<td><em>Fraxinus</em> sp. (ash)</td>
<td>---</td>
</tr>
<tr>
<td><em>Acer</em> sp. (soft maple group)</td>
<td>1 (10) (twig)</td>
</tr>
<tr>
<td><em>Pinus strobus</em> (white pine)</td>
<td>1 (5)</td>
</tr>
<tr>
<td><em>Carya</em> sp. (hickory)</td>
<td>---</td>
</tr>
<tr>
<td>Resinous wood (Count/weight)</td>
<td>---</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>8/0.20 g</td>
</tr>
<tr>
<td>Twigs (Count/weight)</td>
<td>335/8.10 g</td>
</tr>
</tbody>
</table>

(A subsample of ten twigs was selected for analysis. All were identified as *Acer* sp., maple)

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
<table>
<thead>
<tr>
<th>TYPE OF MATERIAL</th>
<th>COLUMN</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td>(4 pc.)</td>
<td>(24 pc.)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>---</td>
<td>32 (17)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>---</td>
<td>9  (4)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>17 (50)</td>
<td>25 (21)</td>
</tr>
<tr>
<td>Ulmus americana (Amer. elm)</td>
<td>67 (25)</td>
<td>23 (29)</td>
</tr>
<tr>
<td>Carv a sp. (hickory)</td>
<td>---</td>
<td>9  (13)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>---</td>
<td>5  (8)</td>
</tr>
<tr>
<td>Platanus occidentalis (sycamore)</td>
<td>---</td>
<td>5 (8)</td>
</tr>
<tr>
<td>Acer sp. (soft maple group)</td>
<td>17 (25)</td>
<td>2  (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CARBONIZED SEEDS (Count)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubus sp. (blackberry)</td>
<td>---</td>
</tr>
<tr>
<td>Galium sp. (bedstraw/cleavers)</td>
<td>---</td>
</tr>
<tr>
<td>Prunus sp. (cherry)</td>
<td>---</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
### Feature 85 (cont.)

#### Zones B & C

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal</strong> (Count/weight)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Platanus occidentalis</em> (sycamore)</td>
<td>---</td>
<td>21 (16)</td>
</tr>
<tr>
<td>Unident. diffuse porous (Type III)</td>
<td>---</td>
<td>21 (13)</td>
</tr>
<tr>
<td>(Ohio buckeye/Aesculus glabra?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Juglans</em> sp. (walnut/butternut)</td>
<td>18 (25)</td>
<td>18 (21)</td>
</tr>
<tr>
<td><em>Ulmus americana</em> (Amer. elm)</td>
<td>18 (25)</td>
<td>15 (16)</td>
</tr>
<tr>
<td><em>Fraxinus</em> sp. (ash)</td>
<td>55 (38)</td>
<td>12 (16)</td>
</tr>
<tr>
<td><em>Quercus</em> sp. (total oak)</td>
<td>9 (11)</td>
<td>7 (11)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pinus strobus</em> (white pine)</td>
<td>---</td>
<td>6 (8)</td>
</tr>
<tr>
<td><em>Carya</em> sp. (hickory)</td>
<td>---</td>
<td>3 (5)</td>
</tr>
<tr>
<td><strong>Twigs (Count)</strong></td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td><strong>Carbonized Seeds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Toxicodendron radicans</em> (poison ivy)</td>
<td>---</td>
<td>1</td>
</tr>
</tbody>
</table>
### Feature 8-6

#### Zones C & D

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal (Weight and (count) %)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>92 (75)</td>
<td>73 (74)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>45 (40)</td>
<td>57 (48)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>8 (25)</td>
<td>25 (25)</td>
</tr>
<tr>
<td>Juglans sp. (walnut/butternut)</td>
<td>---</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>12/0.50 g</td>
<td>35/1.20 g</td>
</tr>
<tr>
<td>Peduncles (Count)</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>Carbonized Nutshell (Count/weight)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carya sp. (hickory)</td>
<td>---</td>
<td>1/0.05 g</td>
</tr>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>1/0.10 g</td>
<td>1/0.10 g</td>
</tr>
<tr>
<td><strong>Carbonized Seeds (Count)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium sp. (bedstraw/cleavers)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Prunus sp. (cherry)</td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td>Rubus sp. (blackberry)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Amelanchier sp. (juneberry/serviceberry)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Leguminosae (bean family)</td>
<td>.1</td>
<td>2</td>
</tr>
</tbody>
</table>

### Zone E

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus sp. (oak total)</td>
<td>100 (100)</td>
<td>100 (100)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>86 (63)</td>
<td>95 (68)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>10/0.20 g</td>
<td>24/2.50 g</td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TYPE OF MATERIAL</td>
<td>COLUMN</td>
<td>50 % Sample</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>30 (26)</td>
<td>51 (48)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>14 (21)</td>
<td>13 (19)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>2 (2)</td>
<td>10 (14)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>3 (2)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unident. ring porous</td>
<td>33 (33)</td>
<td>11 (10)</td>
</tr>
<tr>
<td>(Kentucky coffeetree/Gymnocladus dioica?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ulmus americana (Amer. elm)</td>
<td>---</td>
<td>8 (4)</td>
</tr>
<tr>
<td>Carva sp. (hickory)</td>
<td>---</td>
<td>7 (6)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>3 (7)</td>
<td>4 (6)</td>
</tr>
<tr>
<td>Platanus occidentalis (sycamore)</td>
<td>9 (10)</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Juglans sp. (walnut/butternut)</td>
<td>---</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Acer sp. (soft maple group)</td>
<td>---</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unidentified conifer</td>
<td>---</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Unidentified/possible elm</td>
<td>2 (2)</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>8/2.30 g</td>
<td>27/3.25 g</td>
</tr>
<tr>
<td>Buds (Count)</td>
<td>---</td>
<td>10</td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Peduncles (Count)</td>
<td>---</td>
<td>3</td>
</tr>
<tr>
<td>CARBONIZED NUTSHELL (Count/weight)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus sp. (acorn)</td>
<td>---</td>
<td>2/0.05 g</td>
</tr>
<tr>
<td>CARBONIZED SEEDS (Count)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium sp. (bedstraw/cleavers)</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Rubus sp. (blackberry)</td>
<td>---</td>
<td>3</td>
</tr>
<tr>
<td>Fragaria virginiana (strawberry)</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Solanum sp. (nightshade)</td>
<td>---</td>
<td>2</td>
</tr>
<tr>
<td>Chenopodium sp. (lamb's quarters/goosefoot)</td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td>TYPE OF MATERIAL</td>
<td>COLUMN</td>
<td>50 % Sample</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td>(24 pc.)</td>
<td>(74 pc.)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>67 (54)</td>
<td>58 (51)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>13 (17)</td>
<td>10 (19)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>10 (13)</td>
<td>9 (18)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>3 (4)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Ulmus americana (Amer. elm)</td>
<td>5 (4)</td>
<td>10 (3)</td>
</tr>
<tr>
<td>Juglans sp. (walnut/butternut)</td>
<td>5 (4)</td>
<td>6 (7)</td>
</tr>
<tr>
<td>Unident. ring porous (Kentucky coffeetree/Gymnocladus dioica?)</td>
<td>5 (13)</td>
<td>4 (5)</td>
</tr>
<tr>
<td>Platanus occidentalis (sycamore)</td>
<td>3 (4)</td>
<td>4 (5)</td>
</tr>
<tr>
<td>Carva sp. (hickory)</td>
<td>---</td>
<td>3 (3)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>---</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unidentified conifer</td>
<td>3 (4)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>---</td>
<td>2/0.15 g</td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>---</td>
<td>10</td>
</tr>
<tr>
<td>Peduncles (Count)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Buds (Count)</td>
<td>---</td>
<td>2</td>
</tr>
<tr>
<td>CARBONIZED SEEDS (Count)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium sp. (bedstraw/cleavers)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Viola sp. (violet)</td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td>Toxicodendron radicans (poison ivy)</td>
<td>---</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table

<table>
<thead>
<tr>
<th>TYPE OF MATERIAL</th>
<th>COLUMN</th>
<th>50 % Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td>(40 pc.)</td>
<td>(154 pc.)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>36 (49)</td>
<td>48 (45)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>3 (2)</td>
<td>23 (21)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>---</td>
<td>19 (15)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>---</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Ulmus americana (Amer. elm)</td>
<td>52 (37)</td>
<td>21 (18)</td>
</tr>
<tr>
<td>Acer sp. (soft maple group)</td>
<td>2 (2)</td>
<td>3 (6)</td>
</tr>
<tr>
<td>Unident. ring porous</td>
<td>2 (2)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>(Kentucky coffeetree/Gymnocladus dioica?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betula sp. (birch)</td>
<td>---</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Carva sp. (hickory)</td>
<td>---</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>2 (2)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Platanus occidentalis (sycamore)</td>
<td>---</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Juglans sp. (walnut/butternut)</td>
<td>2 (2)</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Unidentified conifer</td>
<td>---</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>1/0.10 g</td>
<td>10/3.40 g</td>
</tr>
<tr>
<td>Buds (Count)</td>
<td>---</td>
<td>1</td>
</tr>
</tbody>
</table>

### CARBONIZED SEEDS (Count)

| Galium sp. (bedstraw/cleavers)            | 2       | 4           |
| Rubus sp. (blackberry)                    | ---     | 1           |
| Solanum sp. (nightshade)                  | ---     | 1           |
| Chenopodium sp. (lamb’s quarters/goosefoot)| ---     | 1           |
**ZONE E**

<table>
<thead>
<tr>
<th>TYPE OF MATERIAL</th>
<th>COLUMN</th>
<th>50% SAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td>(12 pc.)</td>
<td>(110 pc.)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>94 (83)</td>
<td>63 (63)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>63 (33)</td>
<td>29 (19)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>25 (42)</td>
<td>30 (33)</td>
</tr>
<tr>
<td>Fraxinus sp.</td>
<td>6 (17)</td>
<td>37 (35)</td>
</tr>
<tr>
<td>Unident. diffuse porous (Type V)</td>
<td>---</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>(cucumber tree/Magnolia acuminata?)</td>
<td>---</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Unidentified conifer</td>
<td>---</td>
<td>&lt;1 (1)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>11/0.60 g</td>
<td>36/0.90 g</td>
</tr>
<tr>
<td>Peduncles (Count)</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Buds (Count)</td>
<td>---</td>
<td>1</td>
</tr>
</tbody>
</table>
## Feature 93
### Zones A & B

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50 % Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal (Weight and (count) %)</strong></td>
<td>(19 pc.)</td>
<td>(95 pc.)</td>
</tr>
<tr>
<td>Unident. diffuse porous Type II</td>
<td>17 (11)</td>
<td>41 (34)</td>
</tr>
<tr>
<td><em>Ulmus americana</em> (American elm)</td>
<td>22 (63)</td>
<td>31 (44)</td>
</tr>
<tr>
<td><em>Quercus</em> sp. (white oak group)</td>
<td>56 (16)</td>
<td>20 (6)</td>
</tr>
<tr>
<td><em>Betula</em> sp. (birch)</td>
<td>---</td>
<td>3 (8)</td>
</tr>
<tr>
<td>Unident. ring porous</td>
<td>6 (11)</td>
<td>2 (3)</td>
</tr>
<tr>
<td>(Kentucky coffeetree/<em>Gymnocladus dioica</em>)</td>
<td>---</td>
<td>2 (4)</td>
</tr>
<tr>
<td><em>Fraxinus</em> sp. (ash)</td>
<td>---</td>
<td>34/0.70 g</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>---</td>
<td>39/0.20 g</td>
</tr>
<tr>
<td>Twigs (Count/weight)</td>
<td>8/0.05 g</td>
<td>1</td>
</tr>
<tr>
<td>Peduncles (Count)</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td><strong>Carbonized Nutshell (Count/weight)</strong></td>
<td>2/0.05 g</td>
<td></td>
</tr>
<tr>
<td><em>Quercus</em> sp. (acorn)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juglandaceae (walnut family)</td>
<td>---</td>
<td>3/0.05 g</td>
</tr>
<tr>
<td><strong>Carbonized Tubers</strong></td>
<td>---</td>
<td>1/0.20 g</td>
</tr>
<tr>
<td><em>Nelumbo lutea</em> (American lotus)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Feature 93 (cont)

#### Zones C & D

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal</strong></td>
<td>(9 pc.)</td>
<td>(38 pc.)</td>
</tr>
<tr>
<td>Unident. diffuse porous Type II</td>
<td>---</td>
<td>47 (39)</td>
</tr>
<tr>
<td><em>Ulmus americana</em> (Amer. elm)</td>
<td>14 (11)</td>
<td>18 (31)</td>
</tr>
<tr>
<td><em>Quercus</em> sp. (white oak group)</td>
<td>57 (44)</td>
<td>15 (13)</td>
</tr>
<tr>
<td>Unident. diffuse porous (Type IV)</td>
<td>---</td>
<td>12 (13)</td>
</tr>
<tr>
<td>(black gum/<em>Nyssa sylvatica</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Betula</em> sp. (birch)</td>
<td>14 (33)</td>
<td>3 (8)</td>
</tr>
<tr>
<td><em>Acer</em> sp. (soft maple group)</td>
<td>14 (11)</td>
<td>3 (3)</td>
</tr>
<tr>
<td><em>Fraxinus</em> sp. (ash)</td>
<td>---</td>
<td>3 (3)</td>
</tr>
<tr>
<td><strong>Buds (Count)</strong></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Peduncles (Count)</strong></td>
<td>---</td>
<td>22</td>
</tr>
<tr>
<td><strong>Bark (Count/weight)</strong></td>
<td>15/0.20 g</td>
<td>80/0.90 g</td>
</tr>
<tr>
<td><strong>Twigs (Count/weight)</strong></td>
<td>15/0.10 g</td>
<td>161/2.40 g</td>
</tr>
<tr>
<td><strong>Carbonized Nutshell</strong></td>
<td>---</td>
<td>1/0.05 g</td>
</tr>
<tr>
<td><em>Juglandaceae</em> (walnut family)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbonized Tubers</strong></td>
<td>---</td>
<td>2/0.05 g</td>
</tr>
<tr>
<td><em>probable Nelumbo lutea</em> (Amer. lotus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Carbonized Seeds</strong></td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td><em>Leguminosae</em> (legume family)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
## Feature 98
### Zones A & B

<table>
<thead>
<tr>
<th>Type of Material</th>
<th>Column</th>
<th>50% Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood Charcoal</strong> (Weight and (count) %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>(17 pc.)</td>
<td>(105 pc.)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>80 (60)</td>
<td>76 (72)</td>
</tr>
<tr>
<td>(red oak group)</td>
<td>72 (41)</td>
<td>44 (37)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>---</td>
<td>8 (9)</td>
</tr>
<tr>
<td>Pinus strobus (white pine)</td>
<td>4 (6)</td>
<td>15 (17)</td>
</tr>
<tr>
<td>Ostrya virginiana (hophornbeam)</td>
<td>16 (35)</td>
<td>6 (8)</td>
</tr>
<tr>
<td>Unident. diffuse porous (Type VI)</td>
<td>---</td>
<td>1 (1)</td>
</tr>
<tr>
<td>(cottonwood/Populus sp?)</td>
<td>---</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unidentified conifer</td>
<td>---</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>32/0.60 g</td>
<td>62/2.05 g</td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>15</td>
<td>40</td>
</tr>
<tr>
<td><strong>Carbonized Nuts/Shell</strong> (Count/weight)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carva sp. (hickory)</td>
<td>6/0.10 g</td>
<td>2/0.05 g</td>
</tr>
<tr>
<td>Juglans nigra (black walnut)</td>
<td>---</td>
<td>1/0.10 g</td>
</tr>
<tr>
<td>Juglandaceae (walnut family)</td>
<td>---</td>
<td>7/0.10 g</td>
</tr>
<tr>
<td>Quercus sp. (acorn)</td>
<td>---</td>
<td>28/0.15 g</td>
</tr>
<tr>
<td>Unidentified</td>
<td>---</td>
<td>4/0.10 g</td>
</tr>
<tr>
<td><strong>Carbonized Seeds</strong> (Count)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Galium sp. (bedstraw/cleavers)</td>
<td>---</td>
<td>1</td>
</tr>
<tr>
<td>Rhus sp. (sumac)</td>
<td>---</td>
<td>1</td>
</tr>
</tbody>
</table>

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.
<table>
<thead>
<tr>
<th>TYPE OF MATERIAL</th>
<th>COLUMN</th>
<th>50 % Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOOD CHARCOAL (Weight and (count) %)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carva sp. (hickory)</td>
<td>50 (67)</td>
<td>62 (54)</td>
</tr>
<tr>
<td>Quercus sp. (total oak)</td>
<td>50 (67)</td>
<td>32 (43)</td>
</tr>
<tr>
<td>(white oak group)</td>
<td>---</td>
<td>29 (28)</td>
</tr>
<tr>
<td>Fraxinus sp. (ash)</td>
<td>---</td>
<td>6 (2)</td>
</tr>
<tr>
<td>Bark (Count/weight)</td>
<td>1/0.05 g</td>
<td>7/0.15 g</td>
</tr>
<tr>
<td>Twigs (Count)</td>
<td>---</td>
<td>5 (&amp; thorn)</td>
</tr>
<tr>
<td>CARBONIZED NUTSHELL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus sp. (acorn)</td>
<td>---</td>
<td>2/0.05 g</td>
</tr>
<tr>
<td>Carva sp. (hickory)</td>
<td>---</td>
<td>1/0.05 g</td>
</tr>
</tbody>
</table>
BIBLIOGRAPHY

Asch, Nancy B., Richard I. Ford and David L. Asch

Barr, Kenneth A.

Bettarel, R.L. and H.G. Smith

Billington, Cecil

Campbell, Amy
1983 An analysis and interpretation of the lithic assemblage at the Elam site (20AE195), Allegan County, Michigan. Western Michigan University Honors College Paper; manuscript on file at W.M.U. Department of Anthropology, Kalamazoo, MI.

Cleland, Charles E.

Cogswell, James W.

Core, H.A., W.A. Cote and A.C. Day

Cremin, William M.
1979 The subsistence ecology of the Schwerdt site (20AE127), with special reference to plant food utilization. Paper presented at the Central States Anthropological Society meetings, Milwaukee, WI.


DeFant, David G. 1986 Prehistoric firewood exploitation: A case study from the Carolinian Biotic Province. M.A. thesis, Department of Anthropology, Western Michigan University, Kalamazoo, MI. Ann Arbor: University Microfilms.


Garland, Elizabeth B. and Caven P. Clark

Garland, Elizabeth B., ed.
1984a Archaeological investigation of the Calkins Bridge Site (20AE509), Allegan County, Michigan. Report submitted to Department of Natural Resources, Lansing, MI.


Hastorf, Christine A. and Virginia S. Popper, eds.

Higgins, Michael J.
1980 An analysis of the faunal remains from the Schwerdt Site, a late prehistoric encampment in Allegan County, Michigan. M.A. thesis, Department of Anthropology, Western Michigan University, Kalamazoo, MI. Ann Arbor: University Microfilms.

Kenoyer, L.

Lopinot, Neal H.

Martin, A.C. and W.D. Barkley

McAllister, Paul W.


Parachini, Kathryn E. 1981 *The paleoethnobotany of the Upper Mississippian Component at the Elam Site, a seasonal encampment on the lower Kalamazoo River*. M.A. thesis, Department of Anthropology, Western Michigan University, Kalamazoo, MI. Ann Arbor: University Microfilms.


1991 Personal communication.

