

Middle and Late Archaic Faunal and Floral Exploitation at the Weber I Site (20SA581), Michigan

Beverley A. Smith and Kathryn C. Egan

The Weber I site (20SA581) is important in the Upper Great Lakes region because it has produced stratigraphically discrete occupations dating to the Middle Archaic and Late Archaic periods. Both faunal and floral remains are used for interpretations regarding subsistence, seasonality, and palaeoenvironment. This analysis presents an opportunity to examine the changes in site use and cultural adaptations that took place during the Archaic, a period for which organic preservation on archaeological sites is rare.

Introduction

Direct evidence of subsistence is elusive on Archaic sites in the Great Lakes region. The Weber I site (20SA581), located in the Saginaw Valley of Michigan, has produced the remains of both animals and plants from discrete, sealed occupation strata that represent the Middle Archaic and the terminal Late Archaic periods. This paper presents a zooarchaeological and palaeoethnobotanical analysis from both components.

Good organic preservation and the use of refined recovery techniques from these two occupations allow us to address questions about subsistence practices, seasonality, and palaeoenvironment. Further, the Weber I site presents an opportunity to compare the Middle Archaic and the Late Archaic occupations in order to understand changing environments and subsistence strategies. Our data are derived from several original sources (Lovis and Egan 1986; Egan 1988; Cleland 1989; Smith 1989) in which faunal and floral data are considered as independent analytic categories. We feel that the approach taken here, which considers faunal and floral data together, provides a more comprehensive view of Archaic subsistence strategies and palaeoenvironments.

Background to research

The Saginaw Valley has been a focus of archaeological research in Michigan since the 1950s (Peebles 1978). At least twenty Archaic sites have

been excavated; all but two are considered to date to the Late Archaic/Terminal Archaic period (ca. 4500-2500 B.P.) (Robertson 1987, Figure 4:43).

Prior to excavation at Weber I, only the Andrews site (20SA8) had been attributed to the Middle Archaic on the basis of "...troublesome feature 11... , a fragmentary burial with some red ochre and no grave goods, radiocarbon dated to 3350 B.C.±150 (M-941)..." (Fitting 1975:67). The apparent absence of such early sites led Fitting (1969) to suggest that the Saginaw Valley had been devoid of human population in the Early and Middle Archaic due to its inhospitable environment. Recent palynological studies (e.g. Ahearn and Bailey 1980; Holman *et al.* 1986; Kapp 1977; McMurray *et al.* 1978) have demonstrated that a mixed deciduous and coniferous forest, producing resources sufficient to support human habitation, was present in the Saginaw Valley during the Middle Archaic. Palaeontological finds have demonstrated that wapiti/elk (*Cervus elephus*) was present in Shiawassee County, Michigan, during this period (5840 B.P. ±80-BETA 11881 on wood) (Holman *et al.* 1986); other species, including beaver (*Castor canadensis*), white-tailed deer (*Odocoileus virginianus*), duck (*Anas cf. platyrhynchos/rubripes*), largemouth bass (*Micropterus salmoides*), and several species of turtle, were associated with the elk bone and, therefore, probably date to the Middle Archaic (J. A. Holman, personal communication). Peebles' (1978: 112) proposal that sites from the Middle Archaic are present, but located under several metres of Lake Nipissing sediments, has been supported by the discovery of the lower occupation zone at the Weber I site which was located two metres below the surface (Lovis, ed. 1989). Thus, Middle Archaic peoples did indeed inhabit the Saginaw Valley.

In contrast to the Middle Archaic, the Saginaw Valley was used extensively by Late Archaic peoples (Fitting 1969) and various models for settlement-subsistence behaviour have been formu-

lated. Taggart (1967) suggests that populations aggregated in winter for deer hunting and dispersed in summer to exploit fish, small mammals, and plants. Keene (1981) uses a deductively derived optimal foraging model which reconstructs resource and nutrient availability and non-food requirements (e.g. hides) to produce constraints which would motivate human groups to choose the optimal solution for resource exploitation to satisfy these constraints in four narrowly focussed economic seasons. Keene's model predicts that Late Archaic people would have exploited fish in the spring, practised broad-spectrum collecting in the summer, hunted deer intensively in the fall, and relied on stored foods during the winter. Lovis (1984, 1986) approaches the issue from the premise that during the Late Archaic food availability was unpredictable in the Saginaw Valley due to fluctuating lake levels. He argues that a "risk offsetting strategy", using the entire range of habitats—uplands, upland margins, and lowlands—characterizes the settlement-subsistence pattern. Robertson (1987) combines site function, analyzed through use-wear analysis of stone tools, with settlement and subsistence data, to suggest that Late Archaic peoples moved toward the centre of a residential network within the Saginaw Valley in the fall to exchange information and thereby maximize the productivity of a variable resource base.

These models of Late Archaic settlement-subsistence behaviour are difficult to assess for two important reasons: there are problems with dating, especially for multi-component sites (Lovis and Robertson 1989) and there is little empirical evidence of subsistence activities at sites (Keene 1981:185; Lovis 1986:99; Robertson 1987:24-5, 212).

Geographic setting and site description

The Weber I site is located on the banks of the Cass River near the town of Frankenmuth, Michigan, on the upland margin of the Saginaw Valley (Fig. 1). The Middle and Late Archaic occupation zones are separated by 0.5 metres of culturally sterile alluvial deposits which represent the rising waters of the Nipissing transgression (Monaghan *et al.* 1986). This sterile zone separates the two occupations across the excavation area and there is no evidence that they have been mixed.

Geomorphological investigations at the site suggest that the lower occupation (Occupation Zone II) was deposited late in the Stanley low water stage

(Monaghan and Fay 1989; Monaghan *et al.* 1986). Its accepted, uncorrected, radiocarbon dates are 6230±190 B.P. on bone collagen (BETA-5475) and 4560±200 B.P. on wood charcoal (SI-5595); two other dates on wood charcoal (1940±170B.P.-SI5597 and modern -SI5598) were rejected as contaminated (Monaghan *et al.* 1986). The radiocarbon dates, artifact assemblage, and geological assessment place this occupation within the Middle Archaic period, between approximately 6000-4500 B.P. During this period, the site was situated "...in an estuarine context at the most extreme upriver extension of the Nipissing transgression into the Cass drainage, the embouchure of the Cass into the Shiawassee Embayment. This is a relatively wet habitat" (Lovis 1989a:219).

Occupation Zone I was deposited after the recession of the Nipissing high water stage (Monaghan and Fay 1989) and three uncorrected radiocarbon dates on wood charcoal of 2910±70 B.P. (BETA-5472), 2990±110 B.P. (BETA-5473), and 2990±110 B.P. (BETA-5474) firmly date this occupation to 2900-3000 B.P. (Monaghan *et al.* 1986), that is, to the terminal Archaic period. Lovis states that "Occupation Zone I, a middrainage site on the upland fringe surrounding the Shiawassee Flats, is post-Nipissing, in a situation analogous to that at present" (Lovis 1989a:219).

Recovery and analysis

Occupation Zones I and II were excavated in one square metre units and all soil was water screened through quarter-inch mesh. Ten litre flotation samples were collected from the southwest corner of every other excavation unit as midden controls, and from all zones in features. In total, 1084.5 litres of soil were processed in a Sandy-Cresson open tank flotation system. The heavy and light fractions were collected in No. 16 and No. 80 nylon mesh, respectively. Samples were sorted using low-power binocular magnification (7X-30X).

All bone, charcoal (wood and bark), nut, and tuber specimens larger than 2 mm were recovered and used for the counts and weights in this analysis. All carbonized seeds, regardless of size, were collected. All bone, nut, and carbonized seed specimens were identified to as specific a taxon as possible. The first twenty, randomly chosen, wood charcoal fragments from each flotation sample were similarly identified; additional randomly selected wood charcoal specimens from field collected contexts were also identified. The tuber was classified according to habitat (terrestrial). Iden-

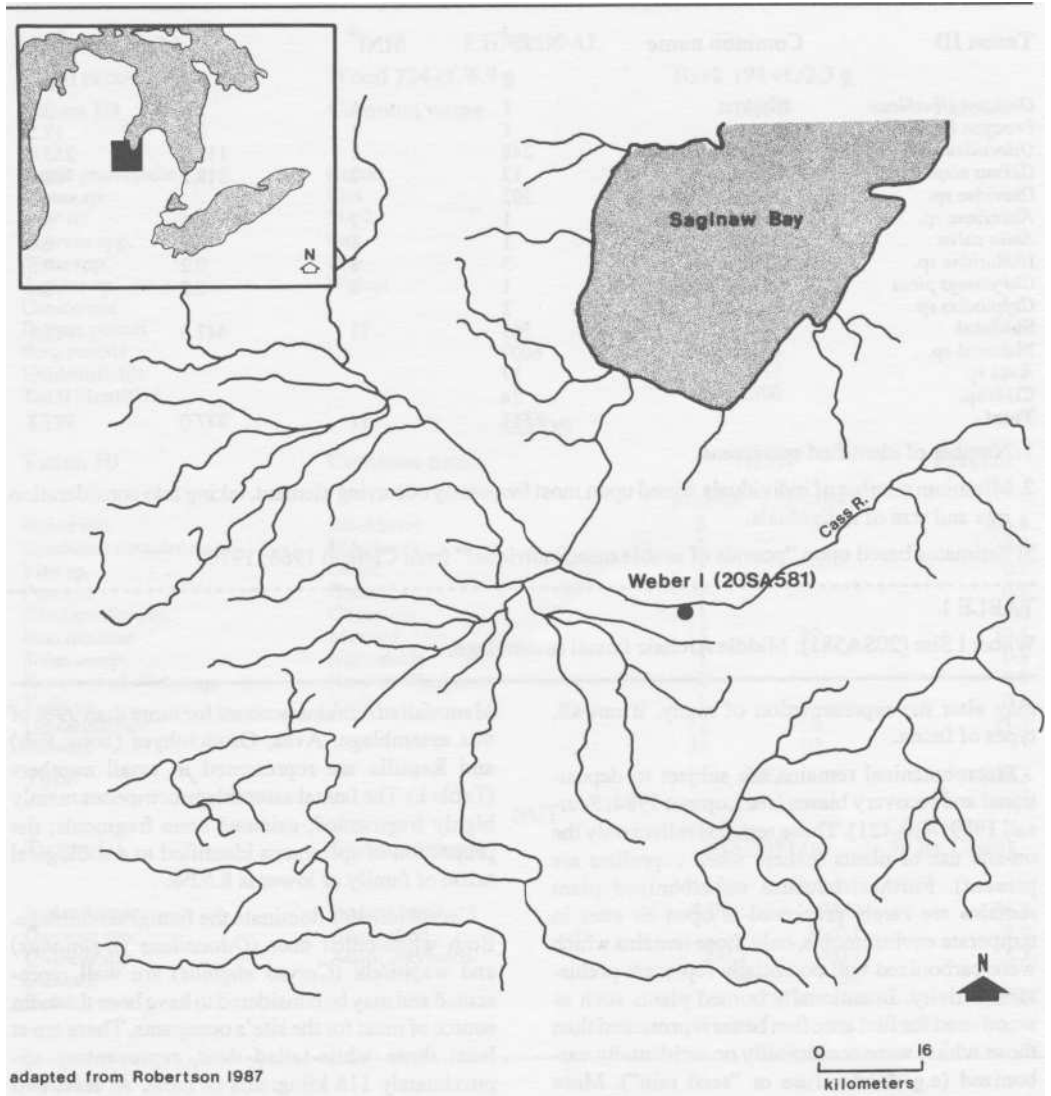


FIGURE 1
Location of Weber I site

tifications were made through the use of modern comparative collections and, in the case of botanicals, also with identification keys (Core *et al.* 1979; Martin and Barkley 1961; Montgomery 1977).

The faunal assemblages are probably biased toward the preservation of dense mammalian bone and teeth. While the presence of more fragile bone from other zoological classes indicates the potential for its preservation, and methods outlined above favour its recovery, birds and fish are probably severely under-represented. It may be argued, how-

ever, that the overall relative importance of the various sources of meat which contributed to the diet is reflected in the faunal sample. In both occupations, an extremely large number of bird and/or fish individuals would be required to upset the proposed importance of cervids in the diet. Furthermore, in an assemblage where bone is highly fragmented, portions of elements of large animals are less likely to possess identifying characteristics. Therefore, bias must be present throughout the Middle and Late Archaic faunal assemblages and

| Taxon ID | Common name | NISP ¹ | MNI ² | Meat Yield ³ | |
|-------------------------------|--------------------|-------------------|------------------|-------------------------|-------|
| | | | | kg | Ibs |
| <i>Ondatra zibethicus</i> | Muskrat | 1 | 1 | 1.0 | 2.1 |
| <i>Procyon lotor</i> | Raccoon | 1 | 1 | 8.0 | 17.5 |
| <i>Odocoileus virginianus</i> | White-tailed deer | 248 | 3 | 116.0 | 255.0 |
| <i>Cervus elephus</i> | Wapiti | 13 | 2 | 318.2 | 700.0 |
| Cervidae sp. | Deer/Wapiti family | 292 | | | |
| Anserinae sp. | cf. Canada goose | 1 | 1 | 2.5 | 5.6 |
| <i>Amia calva</i> | Bowfin | 1 | 1 | 0.9 | 2.0 |
| Ictaluridae sp. | cf. Bullhead | 3 | 1 | 0.2 | 0.5 |
| <i>Chrysemys picta</i> | Painted turtle | 1 | 1 | 0.2 | 0.4 |
| Cryptodira sp. | Turtle sp. | 2 | | | |
| Subtotal | | 563 | 11 | 447.0 | 983.1 |
| Mammal sp. | | 6007 | | | |
| Aves sp. | | 17 | | | |
| Class sp. | | 24 | | | |
| Total | | 6611 | 11 | 447.0 | 983.1 |

1. Number of identified specimens.
2. Minimum number of individuals, based upon most frequently occurring element, taking into consideration age and size of individuals.
3. Estimates based upon "pounds of usable meat/individual" from Cleland 1966; 1970.

TABLE 1 Weber I Site (20SA581): Middle Archaic faunal assemblage.

may alter the representation of many, if not all, types of fauna.

Macrobotanical remains are subject to depositional and recovery biases (see Lopinot 1984; Pearsall 1989: 420-421). These remains reflect only the on-site use of plants (except when coprolites are present). Further, because uncarbonized plant remains are rarely preserved at open-air sites in temperate environments, only those remains which were carbonized will potentially represent prehistoric activity. Intentionally burned plants such as wood used for fuel are often better represented than those which were accidentally or incidentally carbonized (e.g. food refuse or "seed rain"). More durable plant structures, like nutshells, are also more likely to be preserved than those with more fragile structures, such as seeds and tubers. Nonetheless, the use of refined recovery techniques and intensive sampling has demonstrated that valuable subsistence information can be derived through considerations of the relative quantities, the context, and the associations of archaeobotanical remains.

Occupation Zone II: The Middle Archaic

A total of 6,611 faunal specimens, weighing 1,678.4 grams, were recovered through excavation and flotation from an area of 91 square metres.

Mammalian remains account for more than 99% of this assemblage. Aves, Osteichthyes (bony fish) and Reptilia are represented in small numbers (Table 1). The faunal assemblage comprises mainly highly fragmented, calcined bone fragments; the proportion of specimens identified to a zoological taxon of family or lower is 8.52%.

Cervid remains dominate the faunal assemblage. Both white-tailed deer (*Odocoileus virginianus*) and wapiti/elk (*Cervus elephus*) are well represented and may be considered to have been the main source of meat for the site's occupants. There are at least three white-tailed deer, representing approximately 116 kilograms of meat. At least two wapiti are represented, providing an estimated 318 kilograms of meat. The presence of elements representing all portions of the body of these species suggests that whole animals were brought to the site. Many of the specimens identified as Cervidae are fragments of antler and teeth, which undoubtedly came from both white-tailed deer and wapiti but cannot be differentiated as to species.

Medium-sized mammals, birds, and fish are also represented. The major portion of a left premaxilla is identified as raccoon (*Procyon lotor*). Muskrat (*Ondatra zibethicus*) is represented by a lumbar vertebra. Both elements are calcined. These medium-sized mammals together make up an estimated 9 kilograms of meat. A large goose

| CHARCOAL | | | | |
|-------------------------------|---------------------|--------------------|---------|------------|
| Total recovered: | Wood 724 ct./6.7 g | Bark 191 ct./2.3 g | | |
| Taxon ID | Common name | NISP | | Percent |
| | | Midden & Feature | | |
| <i>Fagus grandifolia</i> | Beech | 28 | | 9.2 |
| <i>Ulmus</i> sp. | Elm | 1 | | 0.3 |
| <i>Acer</i> sp. | Maple | 9 | | 2.9 |
| <i>Quercus</i> spp. | Oak | 13 | | 4.2 |
| <i>Pinus</i> spp. | Pine | 25 | | 8.2 |
| <i>Juglans</i> sp. | Walnut | 3 | | 1.0 |
| Coniferous | | 4 | | 1.3 |
| Diffuse porous | | 88 | | 28.8 |
| Ring porous | | 18 | | 5.9 |
| Unidentifiable | | 117 | | 38.2 |
| Total identified | | 306 | | 100.0 |
| SEEDS | | | | |
| Taxon ID | Common name | NISP | | Percent |
| | | Midden | Feature | |
| <i>Rubus</i> spp. | Blackberry | 2 | 3 | 3.8 |
| <i>Sambucus canadensis</i> | Elderberry | 1 | | 0.8 |
| <i>Vitis</i> sp. | Grape | 1 | | 0.8 |
| Poaceae | Grass | 1 | | 0.8 |
| <i>Chenopodium</i> sp. | Goosefoot | 1 | | 0.8 |
| Brassicaceae | Mustard | 18 | 87 | 79.5 |
| <i>Solanum</i> sp. | Nightshade | 1 | | 0.8 |
| Rosaceae cf. <i>Rubus</i> sp. | Rose cf. Blackberry | 1 | | 0.8 |
| <i>Viola</i> sp. | Violet | 1 | | 0.8 |
| Unidentifiable | | 12 | 3 | 11.5 |
| Subtotal | | 39 | 93 | |
| Total | | 132 | | 100.3 |
| NUT | | | | |
| Taxon ID | Common name | NISP/Wt.(g) | | % by Count |
| | | Midden | Feature | |
| Juglandaceae | Walnut family | 14/0.1 | 19/0.2 | 86.8 |
| <i>Quercus</i> spp. | Acorn shell | | 3/<0.1 | 7.9 |
| <i>Quercus</i> spp. | Acorn cotyledon | 2/0.2 | 4/0.1 | 5.3 |
| Subtotal | | 16 | 26 | |
| Total | | 42/0.6 | | 100.0 |

TABLE 2

Weber I site (20SA581): Middle Archaic floral assemblage.

(Anserinae) is known by the presence of the proximal portion of the proximal phalanx of the second wing digit; its identification as Canada goose (*Branta canadensis*) is tentative; this species accounts for about 2.5 kilograms of meat.

Fish identifications are based upon the examination of vertebrae, which are not generally identifiable below the taxonomic level of family. Bowfin (*Amia calva*) is the only living species representing the family Amiidae in the fresh waters of eastern North America (Scott and Crossman 1973:111); therefore the Amiidae vertebra can most probably be assigned to this species. Three vertebrae are

identified to the Ictaluridae, the catfish/bullhead family. The size of these elements suggests that they originate from a species of bullhead; based upon present ranges, possible species are yellow bullhead (*Ictalurus natalis*) and brown bullhead (*Ictalurus nebulosus*) (Scott and Crossman 1973: 595-604). The fish represented would have contributed a little over 1 kilogram of meat to the diet of the site's occupants.

One painted turtle (*Chrysemys pieta*) was identified from a complete calcined neural plate element. This species is a relatively small turtle and would have provided approximately 0.2 kilograms

of meat.

The archaeobotanical sample from Occupation Zone II consists of wood charcoal (724 ct./6.7 g) bark charcoal (191 ct./2.3 g), nutshells and meats (42 ct./0.6 g), and seeds (132 ct.), recovered from 400 litres of floated matrix (Table 2).

The sample of wood charcoal identified to taxon is dominated by beech (*Fagus grandifolia*) and pine (*Pinus* spp.). Maple (*Acer* sp.), oak (*Quercus* spp.), walnut (*Juglans* sp.) and elm (*Ulmus* sp.) are present in lesser quantities. Additional specimens, identifiable only by growth ring pattern, indicate that diffuse porous woods (beech and/or maple) are more abundant than ring porous woods (oak, elm and walnut). Bark charcoal is associated with wood charcoal in consistent quantities and is likely related directly to the burning of wood.

Nutshell forms only a small component of the archaeobotanical assemblage. Midden samples produced fourteen (0.1 g) nutshell fragments of the walnut family (Juglandaceae) and two (0.2 g) acorn (*Quercus* spp.) cotyledon fragments are present. Samples from features contained nineteen (0.2 g) Juglandaceae fragments, three shell and four cotyledon (approximately 0.2 g) *Quercus* spp. fragments.

A total of 132 seeds are represented in the Middle Archaic assemblage; 80% are identified to the mustard family (Brassicaceae). They are concentrated (n=82) in a single feature (Feature 235) associated with nutshell and blackberry seeds. The context and association of these seeds suggest that they are the by-products of cultural activity. Other seeds recovered from Occupation Zone II include a variety of edible fruits (blackberry/*Rubus* spp., elderberry/*Sambucus canadensis*, and grape/*Vitis* sp.). These taxa and others represented in this component (e.g. grass/Poaceae, goosefoot/*Chenopodium* sp., and nightshade/*Solanum* sp.) are common to disturbed habitats such as riverbanks. A single violet (*Viola* sp.) seed is also present. It is unclear whether the occurrence of these seeds is due to natural or cultural factors, although the blackberry seeds associated with mustard seeds and nutshell in Feature 235 may reflect subsistence use. Further, the presence of fruit seeds indicates that a variety of fruits were available to the occupants of the site.

Distribution of faunal and floral specimens in Occupation Zone II

An examination of the distribution of faunal and floral specimens across the site provides informa-

tion about the nature of activity areas, the function of features, and community organization. There is little overlap between floral and faunal remains in the Middle Archaic occupation at Weber I. These food categories appear to have been processed separately (Figure 2). Faunal remains are concentrated in the northeastern portion, and along the eastern margin of the excavated area, where animals appear to have been processed. Feature 230 was defined primarily on the basis of its high bone concentration, mainly cervid remains. Lithic debitage was found mixed with the bone fragments in this feature, suggesting that on-site butchering, marrow extraction, and tool repair were carried out here. An anvil stone, found along the northern margin of the excavated area, lends further support to this interpretation.

While wood charcoal is fairly evenly distributed in low densities across the site, a relatively large concentration of charcoal was found in Feature 235, the only fire pit in the excavated area of Occupation Zone II (Lovis 1989b). Feature 235 also produced large quantities of seed from the mustard family and three blackberry seeds. A high density of nutshell was recovered from Feature 234, which was close to an anvil stone which, based upon Robertson's use-wear analysis of the site's lithic assemblage, was used for stone tool production (1987: 86). It was, perhaps, also used to process nuts. Floral remains are predominantly confined to the southern third of the excavated area. No bone was present in Feature 235, while Feature 234 produced only one small fragment of bone.

Middle Archaic subsistence and seasonality

Cervids, white-tailed deer and wapiti, provided the bulk of the food for the Middle Archaic occupants of the Weber I site. Nuts are also considered to have been a part of the diet because the greatest density of nutshell was not associated with wood charcoal but rather was recovered in features, in association with the remains of other edible plants. Dietary diversity is suggested by the floral and faunal assemblages. In addition to nuts, berries may have been collected. Mustard also appears to have been used as a food, seasoning, or medicine (cf. Erichson-Brown 1979: 461). Fish, turtle, and small mammals probably also made some contributions to the diet.

The faunal and floral assemblages suggest a late summer through fall occupation. Blackberry, elderberry, grape, and mustard mature in late summer.

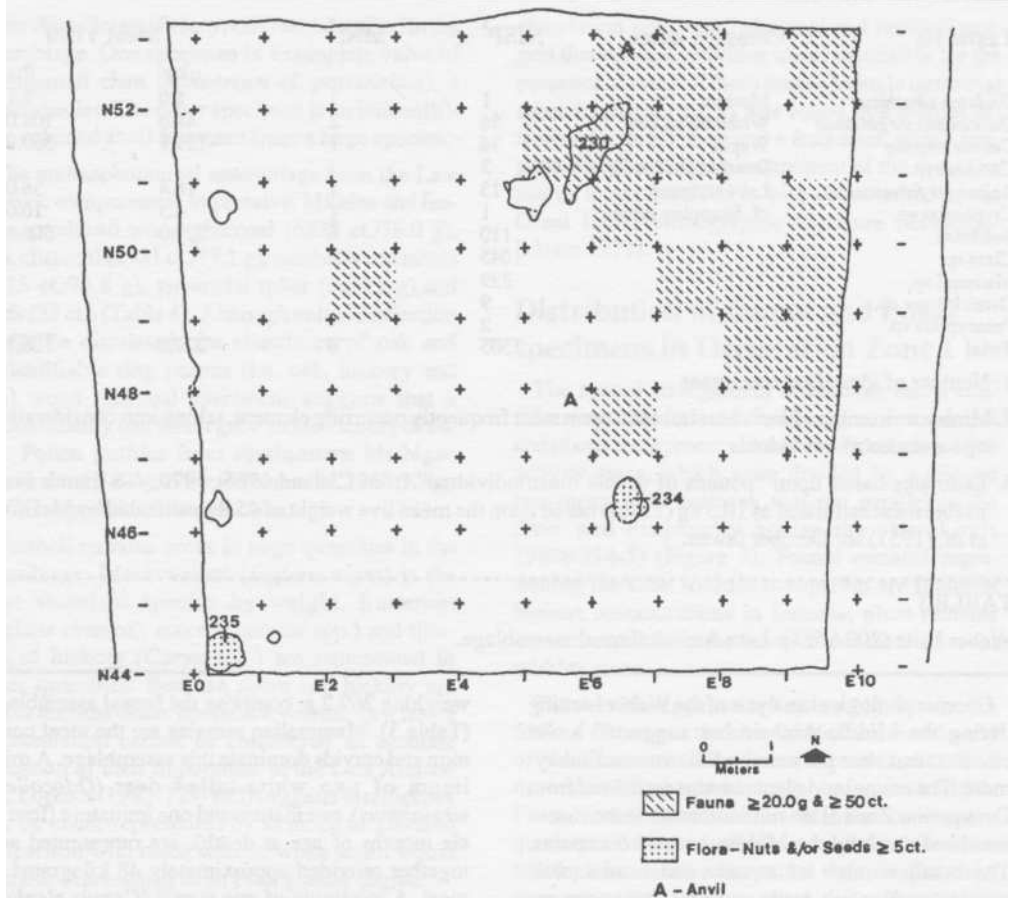


FIGURE 2

Distribution of faunal and floral specimens, Middle Archaic (Occupation Zone II).

Turtles are warm weather species that are available until about October when they go into hibernation (Holman and Harding 1977). Fish species such as bow fm and bullheads are most easily caught before freeze-up.

Fall is suggested by the presence of large amounts of antler; 124 antler fragments occur in the assemblage. Antler matures in the fall in time for the rut. The presence of nutshell is also strong evidence for fall occupation.

Middle Archaic palaeoenvironmental reconstruction

Pollen studies from the region (e.g. Ahearn and Bailey 1980; Gilliam *et al.* 1967; Holman *et al.* 1986; Kapp 1977) suggest that a mixed pine and

hardwood forest grew in southeastern Michigan during the Middle Archaic period, an interpretation supported by the wood charcoal recovered from Occupation Zone II. Diffuse porous taxa, including beech and maple, predominate, although significant quantities of pine and coniferous taxa are also represented. The diversity of taxa, including coniferous woods that do not burn well and significant quantities of wood charcoal in which the anatomical structures have been effectively melted or caramelized (suggesting the burning of green and/or coniferous wood), suggest that firewood was collected opportunistically.

White-tailed deer and wapiti require an ecologically diverse forest habitat, such as that suggested by the floral assemblage. Open areas, a habitat favoured by wapiti, probably existed in the vicinity of the site.

| Taxon ID | Common name | NIS ^{P1} | MN ^{I2} | Meat Yield | |
|-------------------------------|---------------------|-------------------|------------------|------------|-------|
| | | | | kg | lbs |
| <i>Ondatra zibethicus</i> | Muskrat | 1 | 1 | 1.0 | 2.1 |
| <i>Odocoileus virginianus</i> | White-tailed deer | 56 | 2 | 48.0 | 108.0 |
| <i>Cervus elephus</i> | Wapiti | 36 | 1 | 159.1 | 350.0 |
| Cervidae sp. | Deer/wapiti family | 3 | | | |
| <i>Acipenser fulvescens</i> | lake sturgeon | 13 | 1 | 16.4 | 36.0 |
| Cryptodira sp. | cf. Snapping turtle | 1 | 1 | 4.5 | 10.0 |
| Subtotal | | 110 | 6 | 229.0 | 506.1 |
| Class sp. | | 1045 | | | |
| Mammal sp. | | 339 | | | |
| Osteichthyes sp. | | 9 | | | |
| Pelecypoda sp. | | 2 | | | |
| Total | | 1505 | 6 | 229.0 | 506.1 |

1. Number of identified specimens
2. Minimum number of individuals, based upon most frequently occurring element, taking into consideration age and size of individuals
3. Estimates based upon "pounds of usable meat/individual" from Cleland 1966; 1970; 4-6 month fawn usable meat estimated as 10.5 kg (23 lbs) based upon the mean live weight of 45 lbs estimated by McEwen *et al.* (1957) for October fawns.

TABLE 3

Weber I site (20SA581): Late Archaic faunal assemblage.

Geomorphologic al analysis of the Weber I setting during the Middle Archaic has suggested a wet environment near the marshy Shiawassee Embayment. The animal and plant remains recovered from Occupation Zone II do not indicate that the marsh was used much by the Middle Archaic occupants. The small number of aquatic and semi-aquatic species, such as fish, turtle, muskrat, and goose, are incidental components of the assemblage and could have been taken from the adjacent river. The site inventory points to the exploitation of woodland resources, such as deer, wapiti, berries, and nuts. This apparent incongruity may be a result of seasonality. Fall was a time to turn to the forest for major resources and the mixed deciduous and coniferous forest community near the site may have attracted Middle Archaic peoples to the locality during this season.

Occupation Zone I: The Late Archaic

The faunal assemblage from the Late Archaic occupation at the Weber I site is extremely fragmented. Most specimens are calcined bits of bone recovered from feature flotation samples. A large proportion of the faunal remains (69.4%) could not be assigned with confidence to any class designation, although most of these fragments are probably of mammalian origin. A total of 1,505 specimens,

weighing 269.2 g, comprise the faunal assemblage (Table 3). Mammalian remains are the most common and cervids dominate this assemblage. A minimum of two white-tailed deer (*Odocoileus virginianus*), one mature and one immature (four to six months of age at death), are represented and together provided approximately 48 kilograms of meat. A minimum of one wapiti (*Cervus elephus*) would have provided approximately 159 kilograms of meat. Three specimens, two tooth fragments and one calcined antler tip fragment, can be identified only to the Cervidae. The presence of the teeth of both cervid species suggests that whole carcasses were brought to the site for butchering. One muskrat (*Ondatra zibethicus*) represented by a whole calcined caudal vertebra, made a small contribution of about 1 kilogram to the meat supply.

Lake sturgeon (*Acipenser fulvescens*) is also present at the site. A total of thirteen dermal plate fragments reveal that a minimum of one individual is present, representing approximately 16.4 kilograms of meat. Another species of fish is represented by small, calcined vertebral and spine fragments, but could not be identified beyond the class designation. One large turtle species, probably snapping turtle (cf. *Chelydra serpentina*), is represented by a single, partial carapace/plastron element reconstructed from four fragments. This individual probably made a modest contribution of approximately 4.5 kilograms of meat. Two fresh-

water clams (class: Pelecypoda) are identified in the assemblage. One specimen is a complete valve of a fingernail clam (*Sphaerium* cf. *partuneium*), a small species. The other specimen is an unidentifiable calcined shell fragment from a large species.

The archaeobotanical assemblage from the Late Archaic component is impressive. Midden and features produced wood charcoal (6837 ct./76.0 g), bark charcoal (2931 ct./77.1 g), nutshells and meats (1415 ct./73.8 g), terrestrial tuber (ct./0.1 g), and seeds (33 ct.) (Table 4). Although cultural selection cannot be dismissed, the abundance of oak and unidentifiable ring porous (i.e. oak, hickory and elm) wood charcoal specimens suggests that a predominantly oak forest grew in the vicinity of the site. Pollen profiles from southeastern Michigan (Ahearn and Bailey 1980; Gilliam *et al.* 1967; Kapp 1977) support this interpretation.

Nutshell remains occur in large quantities in the assemblage. Black walnut (*Juglans nigra*) is the most abundant species by weight. Butternut (*Juglans cinerea*), acorn (*Quercus* spp.) and thin-shelled hickory (*Carya* spp.) are represented in lesser quantities. Because acorn and hickory are friable and less dense than black walnut, their lesser representation cannot be considered an accurate indication of their importance in the Late Archaic diet. Lopinot (1982: 729-743) suggests that hickory may be under-represented by as much as 200% in comparison with black walnut, while acorn would be under-represented to an even greater degree.

A total of thirty-three carbonized seeds were recovered from Late Archaic flotation samples. These occur in low densities (0.4 seeds/10 litres). All seeds occur in association with wood charcoal and 91% are found with nutshell remains. Summer fruits (blackberry/*Rubus* spp.; elderberry/*Sambucus canadensis*; blueberry/*Vaccinium* sp.; and rose family/Rosaceae cf. *Rubus* sp.) and a variety of other taxa (composite/Asteraceae; mustard/Brassicaceae; bedstraw/*Gallium* sp.; bush clover/*Lespedeza* sp.; morning glory/*Convolvulaceae*; geranium/*Geranium* sp.; hop-hornbeam/*Ostrya virginiana*; and grass/ Poaceae) are represented. There are ethnographic references to the medicinal and technological use of such plants (cf. Erichson-Brown 1979). Naiad/*Najas* sp., an aquatic species, is also present. Some of these taxa may be the by-products of "seed rain" or accidental inclusion (for example, seeds adhering to clothing), but seeds derived from such sources are usually minor components of archaeological assemblages (cf. Pearsall 1989:440). Context and

association with wood charcoal and nutshell suggest that cultural activities were responsible for the presence of many of these seeds. A single terrestrial tuber fragment (0.1 g) was found in a feature associated with nutshell and a fruit seed, which suggests that it was also a component of the diet. The use of tubers for food is well documented in the Great Lakes ethnographic literature (Erichson-Brown 1979).

Distribution of faunal and floral specimens in Occupation Zone I

The spatial arrangement of features and a consideration of feature contents suggest that animals and plants were processed and discarded in separate activity areas, which were divided by a one- to two-metre wide pathway that ran parallel to the river and diagonally across the site (Lovis 1989b:214-5) (Figure 3). Faunal remains representing the Late Archaic occupation are found in highest concentrations in features; plant remains are recovered from the features and their adjacent midden areas.

The deer hindquarters in Feature 211 account for 53% of all bone at the site; this feature was devoid of plant remains. Other features produced 29% of the bone while the midden samples produced 18%. Faunal remains are concentrated in the northeastern quadrant of the excavation area. Most of the identified elements of white-tailed deer, wapiti, lake sturgeon, turtle, and muskrat were found here, closest to the riverbank. This may represent a processing and discard midden. The southern portion of the site also produced a relatively high concentration of bone; some white-tailed deer and wapiti remains are found here.

The greatest density of wood charcoal was found in the southern half of the excavation area. Most specimens of bark charcoal are found in association with wood charcoal in a 1:2 ratio. Feature 227, however, contained an unusually high ratio of bark charcoal to wood charcoal (2.6:1), concentrated in a small basin-shaped zone beneath the surrounding feature matrix. The shape of the feature and the large amounts of charred bark suggest the use of this feature as a smudge pit. The concentration of bone surrounding Feature 227 supports this interpretation and suggests the smudge pit was used for smoking hides, meat, or fish.

Nut processing seems to have been concentrated in the southern half of the site, in and around Features 201, 213, and 222. The highly fragmented

| CHARCOAL | | | |
|--------------------------|---------------------|---------------------|---------|
| Total recovered: | Wood 6837 ct/76.0 g | Bark 2931 ct/77.1 g | Percent |
| Taxon ID | Common name | NISP | |
| | | Midden & Feature | |
| <i>Fagus grandifolia</i> | Beech | 18 | 2.0 |
| <i>Betula spp.</i> | Birch | 4 | 0.5 |
| <i>Ulmus spp.</i> | Elm | 19 | 2.1 |
| <i>Carya spp.</i> | Hickory | 11 | 1.2 |
| <i>Acer spp.</i> | Maple | 19 | 2.1 |
| <i>Quercus spp.</i> | Oak | 161 | 18.1 |
| | White oak group | 27 | 3.0 |
| | Red oak group | 4 | 0.5 |
| <i>Pinus spp.</i> | Pine | 64 | 7.2 |
| <i>Juglans spp.</i> | Walnut | 8 | 0.9 |
| cf. <i>Fraxinus spp.</i> | cf. Ash | 2 | 0.2 |
| Coniferous | | 1 | 0.1 |
| Diffuse porous | | 66 | 7.4 |
| Ring porous | | 155 | 17.4 |
| Semi-ring porous | | 1 | 0.1 |
| Unidentifiable | | 330 | 37.1 |
| Total identified | | 890 | 99.9 |

| SEEDS | | | | |
|-------------------------------|---------------------|--------|---------|---------|
| Taxon ID | Common name | NISP | | Percent |
| | | Midden | Feature | |
| <i>Gallium sp.</i> | Bedstraw | 1 | | 3.0 |
| <i>Rubus spp.</i> | Blackberry | 1 | 3 | 12.1 |
| <i>Vaccinium sp.</i> | Blueberry | 1 | | 3.0 |
| <i>Sambucus canadensis</i> | Elderberry | 1 | 1 | 6.1 |
| <i>Geranium sp.</i> | Geranium | | 1 | 3.0 |
| <i>Ostrya virginiana</i> | Hop-hornbeam | 2 | | 6.1 |
| cf. <i>Lespedeza sp.</i> | cf. Bush-clover | | 1 | 3.0 |
| cf. <i>Najas sp.</i> | cf. Naiad | 1 | | 3.0 |
| Asteraceae | Composite | | 1 | 3.0 |
| Poaceae | Grass | 1 | | 3.0 |
| Convolvulaceae | Morning glory | 1 | | 3.0 |
| Brassicaceae | Mustard | 2 | 4 | 18.2 |
| Rosaceae cf. <i>Rubus sp.</i> | Rose cf. Blackberry | 1 | | 3.0 |
| Unidentifiable | | 1 | 9 | 30.3 |
| Subtotal | | 13 | 20 | |
| Total | | | 33 | 99.8 |

| NUTSHELL | | | | |
|-------------------------|-----------------|--------------|----------|--------------|
| Taxon ID | Common name | NISP/ Wt.(g) | | % by count |
| | | Midden | Feature | |
| Juglandaceae | Walnut family | 324/10.2 | 512/6.6 | 59.1 |
| <i>Juglans nigra</i> | Black walnut | 304/45.9 | 71/6.1 | 26.5 |
| <i>Juglans cinerea</i> | Butternut | 2/0.5 | | 0.1 |
| <i>Carya spp.</i> | Hickory | 9/0.3 | 15/0.6 | 1.7 |
| <i>Corvus americana</i> | Hazelnut | 2/0.1 | | 0.1 |
| <i>Quercus spp.</i> | Acorn shell | 9/20.1 | 135/0.8 | 10.2 |
| <i>Quercus spp.</i> | Acorn cotyledon | 2/0. | 4 30/2.3 | 2.3 |
| Subtotal | | 652/57.4 | 763/16.4 | |
| Total | | 1415/73.8 | | 100.0 |

| TUBER | | | |
|----------------|-------------------|-------------|------------|
| Taxon ID | Common name | NISP/Wt.(g) | % by count |
| Unidentifiable | Terrestrial tuber | 1/0.1 | |
| Total | | 1/0.1 | 100.0 |

TABLE 4

Weber I site (20SA581): Late Archaic floral assemblage.

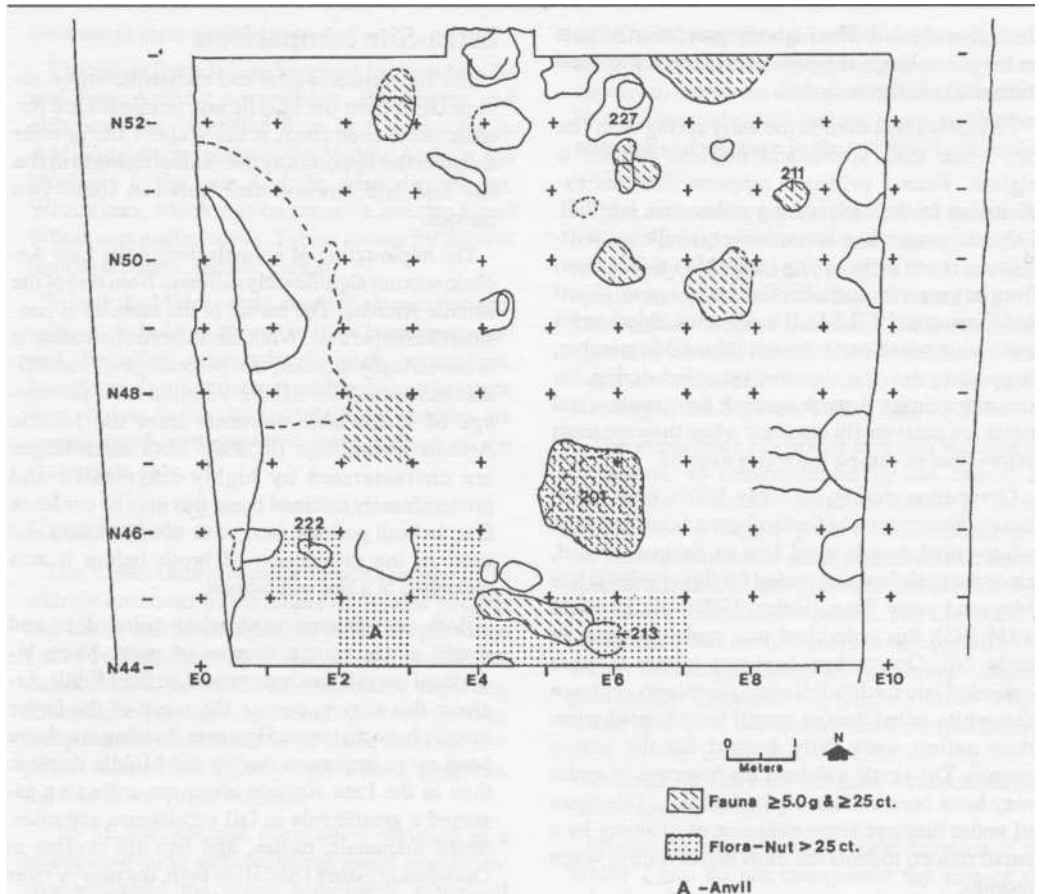


FIGURE 3

Distribution of faunal and floral specimens in Late Archaic (Occupation Zone I).

nature of these remains (i.e. Juglandaceae, *Carya* spp., and *Juglans nigra*) and their association with an anvil stone in N44E2 suggests that processing was directed toward nut oil extraction. Seeds are generally found in association with wood charcoal and nut remains but do not appear to be concentrated in any area.

Late Archaic subsistence and seasonality

The main sources of food for the Late Archaic occupants of the Weber I site were white-tailed deer, wapiti, nuts, and berries. Cervids, black walnuts and acorn dominate the assemblage that relates to diet.

The partial remains of a white-tailed deer were found in Feature 211 during excavation. This gives

some indication of butchering practices. The elements represented comprise the pelvis and include the innominates, sacrum, and lower lumbar vertebrae. This area of the skeleton is surrounded by little meat and the bones are not high in marrow. It was articulated and calcined. This represents the remains of a rather low quality roast or possible a discarded portion of the animal.

The zooarchaeological and archaeobotanical remains suggest a diverse diet drawn from both forest and aquatic environments. The latter was used to procure relatively large meat packages such as lake sturgeon and snapping turtle, as well as muskrat and fish. The most important species were taken from the forest and open areas of the region.

The Late Archaic occupation of the Weber I site took place during warm weather months. The season of occupation is considered to be spring

through early fall. The high representation of nuts in the assemblage suggests that the site was used intensively in the early fall.

Tubers are best used in the early spring or in late fall when their starch and nutrient content is highest. Faunal evidence supports resource exploitation in the early spring rather than late fall. Lake sturgeon move into relatively shallow, swift-moving rivers in the spring (early May to late June) from larger rivers and lakes during the spawn (Scott and Crossman 1973:84). Blackberries, elderberries and blueberries ripen between July and September, suggesting that the site was occupied during the summer months. Aquatic species, fish, muskrat and turtle are most easily obtained when they are most active, that is, during the warm months.

Occupation during the early fall is well established. Nuts mature in September and October. One white-tailed deer is aged four to six months and, since the peak fawning period for this species is late May and early June (Baker 1983:585; Banfield 1974:393), this individual was probably taken in early fall. Occupation does not appear to have extended into the late fall since there is no evidence that white-tailed deer or wapiti were hunted when their antlers were fully formed for the rutting season. The single calcined tip fragment of antler may have been conserved for tool use. This piece of antler displays some evidence of gnawing by a small rodent; rodents are most active during warm months.

Late Archaic palaeoenvironmental reconstruction

Geomorphological studies suggest that the environment around Weber I 3,000 years ago was similar to that in the region before the extensive land clearings of the Nineteenth Century. Zooarchaeological and palaeoethnobotanical analyses support this conclusion. The mixed deciduous forest in the vicinity of the site was high in mast-producing trees (oak, black walnut, butternut, hazelnut, and hickory) and supported a population of white-tailed deer. Wapiti is primarily a grazing species that prefers open areas (Banfield 1974:399); evidence for open areas is provided by the botanical identifications of grasses, ruderal/disturbed habitat plants, and other light-loving taxa such as blueberry, blackberry, and elderberry. Proximity to aquatic environment, the Cass River, is also suggested by the faunal assemblage.

Intra-Site comparison

The zooarchaeological and archaeobotanical assemblages from the Middle and terminal Late Archaic occupation zones at the Weber I site provide an important opportunity to examine changes in site use and site environment between these two periods.

The exploitation of animals during the Late Archaic was not significantly different from that of the Middle Archaic. The nature of the samples is considered comparable. While the Late Archaic sample is numerically smaller, the percentage of identifiable elements (7.28%) is very similar to the percentage of identifiable elements from the Middle Archaic assemblage (8.52%). Both assemblages are characterized by highly fragmented and predominantly calcined bone; this may be evidence that, in both periods, bone was often crushed and used in the production of broth before it was deposited in a fire and burned.

Both occupations used white-tailed deer and wapiti as their main sources of meat. More individual cervids are represented in the Middle Archaic; this may in part be the result of the larger sample from that zone. However, hunting may have been more important during the Middle Archaic than in the Late Archaic when nut collecting assumed a greater role in fall subsistence activities. Small mammals, turtles, and fish are present in Occupation Zones I and II. In both, the nearby river environment was a source of animals incidental to the diet. The slightly wider variety of species in the Middle Archaic faunal assemblage is considered to be, at least in part, due to its larger size.

Some differences between the two occupations may be related to site function. The Middle Archaic is interpreted as a "logistic camp" (Lovis, in press) of shorter duration than the longer-term warm season Late Archaic occupation. The floral remains from the Late Archaic are certainly denser and suggest a heavier reliance on plant resources than during the Middle Archaic. Palaeoethnobotanical analysis indicates that a forest dominated by more southerly mast-producing taxa replaced the Middle Archaic pine and beech/maple forest.

Both occupations occur during the early fall when nut resources are available. The use of nuts is greater in the Late Archaic. Lovis and Egan (1986:34) state that: "The abundance and diversity of nut resources in the terminal Late Archaic is both a reflection of changing resource use patterns and the changing forest composition and concomitant

increase in mast-producing trees."

The use of fruits is demonstrated for both Middle and Late Archaic occupations. Blackberry and elderberry are identified from both assemblages. Additional fruits, grape in the Middle Archaic and blueberry in the Late Archaic, were also present. Weedy taxa, which may be intrusive, are also found in both occupation zones. Tubers appear for the first time in the Late Archaic period.

In both the Middle and Late Archaic occupations, animals and plants appear to have been processed and discarded separately. In each occupation, faunal remains are concentrated in the northeastern area, closest to the river, while floral remains are concentrated in the southwestern portion of the excavation area.

Conclusion

The Weber I site presents a unique opportunity to address questions of the nature of Middle Archaic and Late Archaic occupations in the Upper Great Lakes region. Organic preservation from sealed, dated contexts has allowed conclusions regarding subsistence practices, seasonality of occupation, and palaeoenvironments to be made from the empirical data which directly reflect these concerns, the faunal and floral remains.

The Middle Archaic occupation occurred in a mixed hardwood and coniferous forest near extensive wetlands; the forest community contained mast-producing walnut/hickory and oak trees, whose nuts were exploited. Berries were also exploited and mustard was collected during this late summer and fall occupation. White-tailed deer and wapiti appear to have been the staple food of this occupation. Kills were brought whole to the site. Small animal resources, such as raccoon, muskrat, fish, and goose, provided additional sources of food. Although the Saginaw region was a relatively wet environment, the marsh areas were not widely exploited in this occupation. Fall appears to have been a time to turn to terrestrial and grassland habitats for large meat packages during the Middle Archaic. Occupation Zone II provides the only source of direct evidence so far recovered for Middle Archaic subsistence in present-day Ontario and Michigan.

By terminal Late Archaic times, an oak-hickory forest community had become established in the area. During the late spring, resources such as lake sturgeon and tubers were exploited and, through the warm weather season, turtles, fish, muskrat, white-

tailed deer, wapiti, and berries were used. In the early fall, the procurement and processing of nuts appears to have been an important focus of activity. Nuts, particularly black walnut, acorn, and hickory, were a major resource in the terminal Late Archaic occupation.

Prior to the excavation of the Weber I site, models of Late Archaic subsistence-settlement patterns had necessarily been general (Taggart 1967) and based upon a poor empirical data base (Keene 1981). The Late Archaic Weber I faunal and floral assemblage does provide such empirical evidence from a well-dated context which allows us to refine our understanding of the Saginaw Valley Late Archaic.

The importance of cervids in warm weather occupations, as demonstrated by the faunal assemblage from Occupation Zone I, is not appreciated by Taggart (1967), whose model stresses the exploitation of small mammals and aquatic species in summer and proposes that cervids were primarily a cold season resource. The Late Archaic subsistence data from Weber I is considered to fall within the "broad-spectrum collecting" strategy predicted for the summer by Keene's model (1981). Keene, however, underestimates the importance of nuts in the early fall subsistence regime as evidenced by the Late Archaic archaeobotanical assemblage at Weber I.

Models developed prior to the excavation of the Weber I site do not incorporate the role of the uplands, where forests and grasslands dominate, in the Late Archaic settlement system in the Saginaw Valley. Lovis' work acknowledges the use of the upland environment and both Lovis (1984, 1986) and Robertson (1987) emphasize the variability of the resource base exploited during the Late Archaic. The subsistence data from Weber I supports the notion of an economy based upon the use of a variety of resources from a diverse range of habitats in the late spring through early fall occupations of the Saginaw Valley during the Late Archaic period.

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