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Final Report

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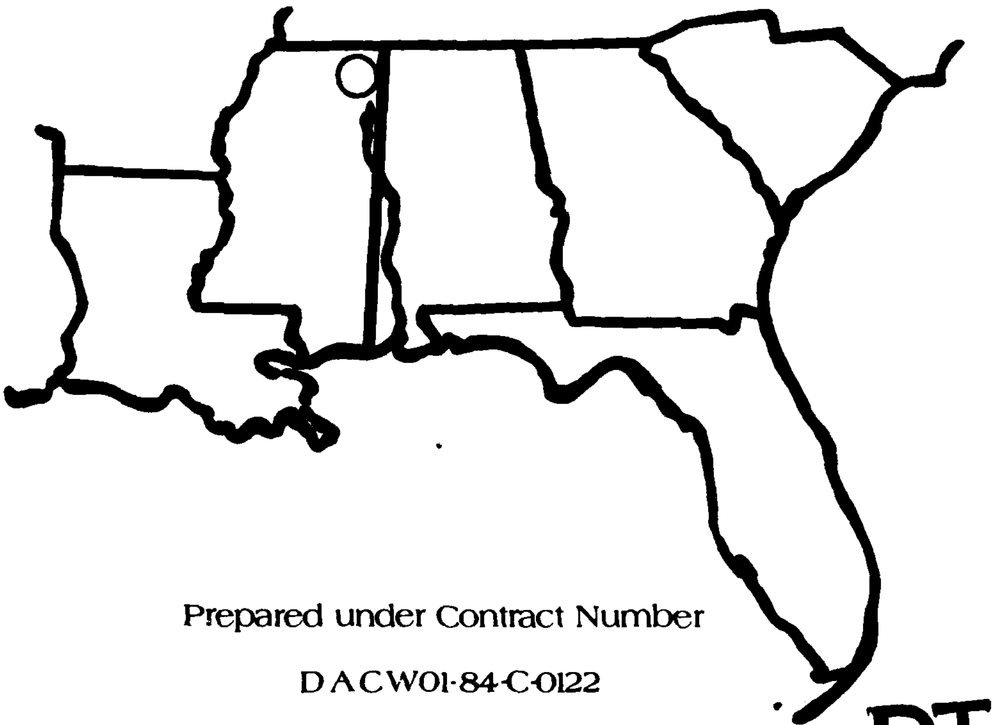
The Midden Mound Project

Judith A. Bense, Editor



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Final report of investigation of 11 sites in the River and Canal Sections of the Tennessee-Tombigbee Waterway in northeast Mississippi. All work conducted between January 1980 and December 1986. The focus of this project was to obtain an adequate sample of primarily Archaic Stage deposits from sites in the floodplain of the Upper Tombigbee Valley. Samples were also obtained from single component of the Middle Gulf Formational and Late Woodland Stages. The project included detailed chemical and mineralogical studies of site soils, geomorphology, botany and archaeomagnetics. (Continued on reverse.)

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20. Detailed archaeological modal analyses were performed on a sample of lithics and ceramics. Controlled replication and use wear experiments of Archaic lithic systems were also performed. The Early and Middle Archaic components (ca. 10,000-5,000 B.P.) had well preserved features and middens and provide one of the few large data bases for this time period in the Southeast. One factor in this preservation was documented by the soil studies which identified a strong mineral bonding between the organics and the annually deposited sand grains that excluded the sites from leaching and percolation forces. The effects of the xeric mid-Holocene climatic episode (Altithermal) were well expressed both geomorphologically and culturally. The cultural response to this period was an intense nucleated settlement pattern in large floodplain base camps and the pedological response was a decrease in the sedimentation rate and the formation of a well developed soil. The information produced in this project is integrated in this report in two detailed models of the environment and the cultural adaptation to it during the Archaic and Middle Gulf Formation Stages (ca. 10,000-2,000 B.P.) in the Upper Tombigbee Valley.

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THE MIDDEN MOUND PROJECT

Judith A. Bense, Editor

Produced under Contract Number DACW01-84-C-0122
between
The U.S. Army Corps of Engineers, Mobile District
and
The University of West Florida,
Office of Cultural and Archaeological Research
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May 1987

Judith A Bense

-A-

ABSTRACT

THE MIDDEN MOUND PROJECT FINAL REPORT
J.A. BENSE, EDITOR 1987

This is the final report of ~~the~~ a contract to investigate 11 sites in the River and Canal Sections of the Tennessee-Tombigbee Waterway in ~~extreme~~ northeast Mississippi. It is a comprehensive account of all three phases of the investigations conducted between January 1980 and December 1986. The focus of this project was to obtain an adequate sample of primarily Archaic Stage deposits from sites in the floodplain in the Upper Tombigbee Valley. Samples were also obtained from single component sites of the Middle Gulf Formational and Late Woodland Stages. The project included detailed chemical and mineralogical studies of site soils, geomorphology, botany and archaeomagnetics. Detailed archaeological modal analyses were performed on a sample of lithics and ceramics. Controlled replication and use-wear experiments of Archaic lithic systems were also performed. The Early and Middle Archaic components (ca. 10,000-5,000 B.P.) had well-preserved features and middens and provide on the the few large data bases for this time period in the Southeast. One factor in this preservation was documented by the soil studies which identified a strong mineral bonding between the organics and the annually deposited sand grains that excluded the sites from leaching and percolation forces. The effects of the xeric mid-Holocene climatic episode (Altithermal) was well expressed both geomorphologically and culturally. The cultural response to this period was an intense nucleated settlement pattern in large floodplain base camps and the pedological response was a decrease in sedimentation rate and the formation of a well-developed soil. The information produced in this project is integrated in this report in two detailed models of the environment and the cultural adaptation to it during the Archaic and Middle Gulf Formational Stages (ca. 10,000 - 2,000 B.P.) in the Upper Tombigbee Valley.

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CHAPTER I INTRODUCTION

This is the final report of the northeastern Mississippi Tennessee-Tombigbee Waterway archaeological investigations conducted between January, 1980 and December, 1986 by the Office of Cultural and Archaeological Research of the University of West Florida. The work was performed in three phases under contract to the U.S. Army Corps of Engineers, Mobile District. Interim reports were written for Phase I (Bense 1982) and Phase II (White 1983). This is the final report for the project, and information from all phases of the project is presented. The archaeological investigations consisted of data recovery of eight sites and testing of seven sites between Aberdeen and Ryan's Well, Ms (the Aberdeen Pool through Lock E of the Canal Section of the Tennessee-Tombigbee Waterway).

The U.S. Army Corps of Engineers was authorized to construct a navigable waterway between the Tennessee and Tombigbee Rivers when Congress passed the Rivers and Harbors Act of 1946. Twenty-six years of planning and study elapsed before construction on the Gainesville Lock and Dam began in 1972. The waterway (Figure 1) extends north from its southern terminus at Demopolis, Al to the East Fork of the Tombigbee River. It proceeds up Mackey's Creek (a tributary of the East Fork of the Tombigbee River), through Bay Springs, over the divide separating the Tombigbee and Tennessee River drainages, and then debouches into Yellow Creek, which is part of the Pickwick Landing Reservoir near the common boundary of Alabama, Mississippi, and Tennessee.

The waterway project has three sections. The southernmost is the River Section. It consists of the Tombigbee River made navigable by widening riverbanks, cutting through oxbows and narrow bends, and constructing four artificial lakes, each with a lock-and-dam complex. The next portion of the waterway is the Canal Section, a 91 m (300 ft) wide excavation roughly paralleling the East Fork of the Tombigbee River controlled through a series of five lock-and-dams. The last section is the Divide-Cut, a 43 km (26.7 mi) canal through the ridge that divides the Tombigbee Valley from the Tennessee Valley, with the Bay Springs Lock and Dam at the southern terminus. The canal attains a maximum depth of 53 m (175 ft) at the peak of the divide. The northern terminus of the waterway flows into the Yellow Creek, a tributary of the Tennessee River which provides access to the Tennessee River System.

Management of the archaeological resources in the Tennessee-Tombigbee Waterway began with the 1970 National Park Service survey of the proposed Gainesville Lake Section. The first reconnaissance surveys covered large areas in a short period of time. For example, the first survey in the Mississippi portion of the waterway covered a 120 mi (193 km) route from the Alabama border to the Tennessee River and was conducted in less than two months (McGahey 1971; Lewis and Caldwell 1972). Later surveys divided the Mississippi portion of the River Section into smaller units which permitted a more detailed investigation (Rucker 1974; Blakeman 1975, 1976). However, the problems of severe time limitations, large study areas, and poorly defined boundaries continued. This situation was largely repeated in the Alabama portion of the River Section with an initial cursory survey of the Gainesville Lake area (Lewis and Caldwell 1972), which was followed by a limited series of excavations at large sites (Jenkins 1982; Nielsen and Moorehead 1972; Nielsen and Jenkins 1973; Peebles 1981). The problems of inconsistent surveying were recognized when previously neglected portions of the waterway were surveyed in mid-1976 (Atkinson and Elliott 1978), and many new sites were found in the River Section.

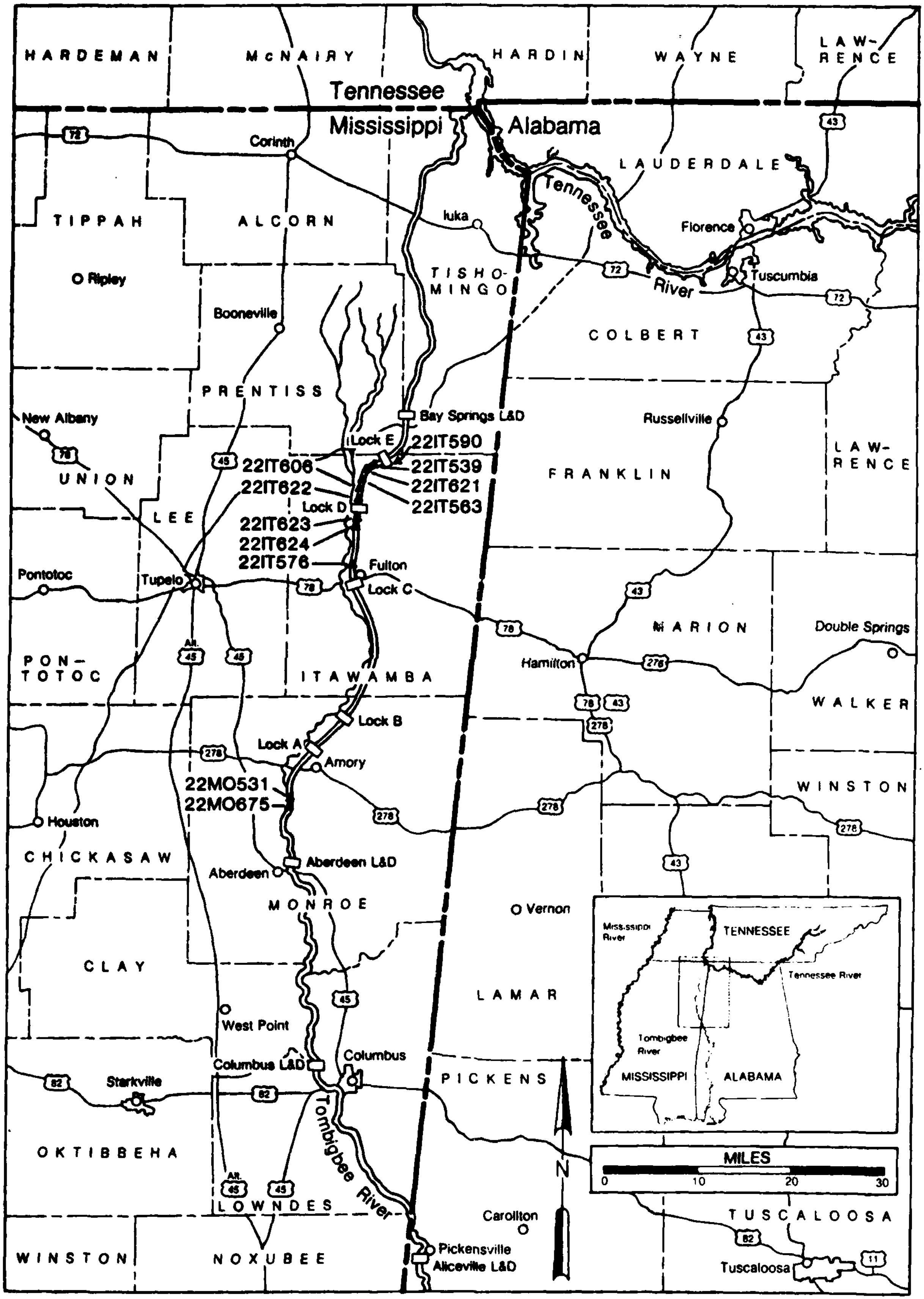


Figure 1. Regional map with location of archaeological sites investigated

Construction on the waterway progressed rapidly, and by February of 1977 it was apparent that a mechanism had to be created which integrated previous archaeological findings into a mitigation program capable of being carried out within the established construction schedules. Almost 700 archaeological sites had been discovered within the limits of the waterway by 1977. It was then agreed that the establishment of a National Register District was the only feasible way to manage the diverse archaeological resources present within the waterway that had not been covered by previous individual memoranda. The Tombigbee River Multi-Resource District was defined and encompasses almost all of the waterway in a corridor 8 km (4.96 mi) wide and approximately 280 km (175 mi) long from Gainesville, Al to Paden, Ms. It was declared eligible for the National Register of Historic Places on September 27, 1977.

The four-stage mitigation plan for the district had two separate strategies: preservation and data recovery and it addressed 1) problems of survey bias, 2) evaluation of site significance and information, 3) excavation priorities, and 4) previously investigated sites with insufficient information available.

PROJECT DESCRIPTION

The Midden Mound project reported here developed as a result of a large testing project in the River and Canal Sections (Bense 1982). Testing documented that in the Upper Tombigbee Valley (UTV) intact Archaic, Gulf Formational, and Woodland deposits were present in the impact zone both in the floodplain and on the edge of the first terrace. Most of the significant sites contained thick, organically stained midden deposits that had a mound-shaped cross-section, locally referred to as "midden mounds." This project was designed to recover data from eleven sites with Archaic, Gulf Formational, and Woodland deposits in and near the floodplain of the Upper Tombigbee Valley. Prior to this time, little or no information had been retrieved on the Archaic and Gulf Formational stages in previous compliance work in the waterway. These sites were the focus of this project.

The Midden Mound project had three phases: Phase I (1979-1982) initial research design and data recovery and preliminary analysis of material; Phase II (1982-1983) refinement of the research design and data recovery from specific chronological periods; and Phase III (1984-1987) the final refinement of the research hypotheses, analysis of specific data sets, and preparation of the final report.

Construction schedule of the waterway and the location and configuration of the sites investigated were influential factors in the project organization. The construction schedule dictated that at least two sites had to be excavated simultaneously in Phase I. Concurrently, field laboratories and data management systems had to be established. Although refinements were introduced for Phase II, the same systems of field, laboratory, and data management were used to insure comparability.

The project has had one Principal Investigator, however most staff members changed with the three phases of this seven-year project. The project included a group of consultants in soil morphology, fluvial geomorphology, botany (including macro and microbotanics), archaeozoology, archaeometry, physical anthropology, and archaeology. The Phase I staff was the largest (75-80 persons). During Phases I and II headquarters was in Fulton, Ms; Phase III was conducted at the University of West Florida campus in Pensacola, Fl.

This report is the final report of the Midden Mound project. It supersedes the interim reports of the previous two phases of the project (Bense 1982; White 1983). The interim reports, however, contain the bulk of the data recovered from the sites and should be used for reference purposes. All raw data are stored on computer tape which can be ordered from the University of West Florida. Summary tables of the data (artifacts) in each excavation block and level are available from the University of West Florida on microfiche.

CHAPTER II THE SETTING

PHYSICAL ENVIRONMENT

PAST CONDITIONS

GEOMORPHOLOGY

The study area is located in the Tombigbee Hills region of the Gulf Coastal Plain. The Tombigbee Hills that lie within the study area are comprised of unconsolidated marine sediments of Upper Cretaceous age. The Eutaw and Tuscaloosa formations outcrop in the area and provide the parent material for the upland soils and alluvial deposits (Stephenson and Monroe 1940). The Tuscaloosa formation is characterized by irregularly bedded sand, clay, and gravel, while the Eutaw formation is generally comprised of cross-bedded glauconitic sand and clay. The soils and sediments of the Tombigbee Hills have been eroded and redeposited on the Tombigbee River floodplain during the Pleistocene and perhaps late Pliocene time (Stephenson and Monroe 1940). Current Holocene sediments in the active floodplain are heterogeneous and related to current erosion and deposition processes.

Muto and Gunn (1985) described the geomorphology of the Upper Tombigbee Valley. The valley began forming during late Tertiary times (ca. 30 million years ago) after being uplifted as part of eustatic rebound incident to the recession of the Cretaceaous seas. Continued relative uplift during the Pliocene and Pleistocene resulted in one Plio-Pleistocene terrace and four Pleistocene terraces. During the development of the valley terraces, the river channel has generally migrated to the west in response to the dip in the underlying sediments.

During the Pleistocene epoch, depositional and erosional cycles were related primarily to glacial and interglacial conditions. Erosion occurred during the later parts of interglacial stages as sea level fell and during glacial periods of low sea level. Depositional cycles occurred during early and middle interglacial stages when sea levels were high. The four cycles of erosion and deposition developed in successively lower river levels producing the four Pleistocene terraces of the Tombigbee Valley. These terraces are usually well dissected and composed of mixed alluvial sands and gravels. Finer-grained materials occur only locally and are associated with relic oxbows.

During the Holocene, terrace formation has continued, and two terraces in the floodplain have been identified. The highest is the Early Holocene terrace and occurs between 1-7 m (3.3-23 ft) above the channel. The Late Holocene terrace is the lowest and occurs between 1-3 m (3.3-9.9 ft) above the channel. In the Upper Tombigbee Valley, north of Smithville, Ms, most of the Early Holocene terrace deposits appear to have been eroded and reworked with only small remnants remaining. The Late Holocene terrace is present throughout the valley and is usually dominated by fan deposits from high-gradient side-streams.

Comparisons of the Holocene terraces indicate that the Tombigbee River has not changed significantly during the Holocene. The entire floodplain area appears to have remained essentially the same during this period.

PALEOSOLS

Within the Holocene terraces Muto and Gunn (1985) and work associated with this project have identified three paleosols based on the alluvial chronology and soils associated with dated archaeological materials. These Early, Middle, and Late Holocene soils formed in overbank and bar deposits. The Early and Middle Holocene soils have often been eroded and are usually buried. Formation of the Early Holocene soil began in the Early Holocene and persisted until approximately 7,000 years ago. At that time it was either buried (south of Columbus, Ms), eroded (north of Columbus, Ms), or slightly eroded and overlain by fluvial sediments in which pedogenesis continued. Formation of the Middle Holocene soil persisted until approximately 3,000 years ago. In some instances the Middle and Early Holocene soils form a bisequem, the lower element of which is the degraded Early Holocene soil B horizon. The Late Holocene soil consists of modern (post-3,000 B.P.) deposits and is poorly drained and organically rich.

PRESENT CONDITIONS

The present topography of the Upper Tombigbee Valley ranges from nearly level in the floodplains and terraces to steep in the adjoining uplands. Elevations range from 75 m (250 ft) NGVD in the floodplain to 122 m (406 ft) and greater in the uplands. The floodplain commonly exceeds a width of 1.5 km (0.93 mi) and contains numerous meandering sloughs, abandoned river cutoffs, and streams entering from the uplands. The active river channel is generally located in the western part of the floodplain.

The well-dissected uplands bounding the floodplain have steep-sided slopes with narrow ridges and valleys. The streams are deeply incised and form a dendritic drainage pattern with a relatively low entrance angle into the Tombigbee floodplain. The tributary valleys in the Upper Tombigbee Valley are usually long and narrow and have steeply sloping valley walls. Ground slope in the floodplains is usually gentle and often almost nil.

The floodplain consists of the floodbasin and Holocene terraces. The geomorphic units of the floodbasin include channels, chute cutoffs, point bars, levees, splays, marshes, oxbows, and undifferentiated floodbasin areas. The Holocene terraces include local fans, levees, fan veneers, and colluvial units, all of which can also occur in the floodbasin. The terrace is a periodically flooded depositional surface and actually defines the limits of the floodplain. The higher portions of the Holocene terrace are only affected by high-magnitude floods (hundred-year intervals) and are semi-relic surfaces.

Hilgard (1860) called the study area the Northeast Prairie Region. The prevalent forest trees in antebellum times was shortleaf pine (Pinus echinata), blackjack oak (Quercus marilandica), post oak (Q. stellata), and chestnut (Castanea dentata). The narrow bottom of Mackey's Creek and its gentle slopes possessed a forest of Spanish oak (Q. falcata), other oak species, and hickories (Carya sp.), but lacked pines. East of the Tombigbee floodplain, the land surface is very broken with the coarse red-orange soil of the Tuscaloosa and Eutaw formations. South of Fulton, Ms, red loam soil is more frequent and is covered by large scarlet oaks (Q. coccinea), occasional black oaks (Q. velutina) and white oaks (Q. alba), as well as hickory and shortleaf pine.

Just north of Smithville, Ms begins a low first terrace or high Early Holocene terrace 3.2-9.6 km (2.0-5.9 mi) wide bordering the river. This area is heavily farmed today. In 1860 the vegetation consisted largely of loblolly pine (*P. taeda*) and flowering dogwood (*Cornus florida*). Near Smithville those species were accompanied by blackjack, post, Spanish and scarlet oaks; closer to the river, cypress (*Taxodium distichum*), tupelo gum (*Nyssa aquatica*), hackberry (*Celtis occidentalis*), shellbark hickory (*Carya laciniosa*), and ash (*Fraxinus spp.*) were their associates (Hilgard 1860:257-258).

The dominant trees of the hills and slopes were shortleaf and loblolly pines. Associated species included blackjack, post, Spanish, and white oaks on the lower slopes. The swamp chestnut oak (*Q. prinus*) and black oaks, dogwood, and hickory were common on the uplands.

After logging at the turn of the 20th century in the floodplain, there were only remnants of a "once good growth" (Lowe 1921:32) of white water oaks (*Q. nigra*), willow oaks (*Q. phellos*), and basket oaks (*Q. Prinus*), sycamore (*Platanus occidentalis*), beech (*Fagus* sp.), river maple (*Acer* sp.), black gum (*Nyssa sylvatica*), sweet gum (*Liquidambar styraciflua*), and cypress. Associated species included hackberry, ash, redbud (*Cercis canadensis*), great-leaved magnolia (*Magnolia macrophylla*), silverbell (*Halesia carolina*), storax (*Styrax* sp.), paw-paw (*Asimina tribola*), and red birch (*Betula* sp.). A number of these reach their southern limit of distribution in Mississippi.

In a more recent study, Zary (1979) found several forest types intermingled within Itawamba County. The slopes are occupied by oak-hickory, oak-pine, and loblolly-shortleaf pine forests. The bottomlands of the Tombigbee River and Mackey's Creek are covered by a hardwood forest composed of tupelo and black gums, sweet gum, oak, and cypress. Common trees associated in this forest included willow, ash, elm (*Ulmus* sp.), hackberry, maple, and cottonwood (*Populus deltoides*). An ash-elm-cottonwood forest is intermingled with the above type. This association includes willow (*Salix* sp.), sycamore, beech, and maple.

To reconstruct the vegetational history of the study area, flora near four major archaeological sites was studied. Plant communities examined quantitatively included a steep oak-hickory slope near 22It563 and a floodplain levee near 22It590 (Figure 2).

Plots of 100x100 m (333 ft) were established in areas of homogeneous vegetation. Each tree greater than 0.1 m (3.9 ft) diameter at breast height (DBH) was recorded. Woody and herbaceous plants less than 0.1 m (3.9 ft) DBH were counted by taxon over the entire upland plot and on a strip 30x100 m (100x333 ft) at the eastern end of the levee plot. Formal plots were not established on or near 22It539 or 22It576, because most of the vegetation had been cut on the sites and the surrounding floodplain levee before the botanical survey was initiated. However, a list of the remaining taxa on these sites was compiled.

The woody species composition of the two plots is presented in Table 1. Oak, hickory, sweet gum, red maple, and dogwood were found in both communities. Gum, beech, elm, tulip poplar (*Liriodendron tulipifera*), ironwood (*Carpinus* sp.), and hop-hornbeam (*Ostrya* sp.) appeared only in the floodplain community; whereas, alder (*Alnus*), hackberry, birch, sassafras (*Sassafras albidum*), and sumac (*Rhus* sp.) were confined to the upland plot. The presence of species recognized as successional, i.e., red maple, elm, tulip poplar, hackberry, and birch, and the large percentage of trees less than 0.1 m (3.9 ft) DBH is indicative of communities 25-50 years into secondary succession. The large numbers of red maple and hop-hornbeam trees were probably the offspring of particularly well-adapted individuals or populations.

Although the vegetation which developed in the first one to ten years after disturbance of a habitat may not be typical of the original climax forest, later successional stages resemble those which were present in the

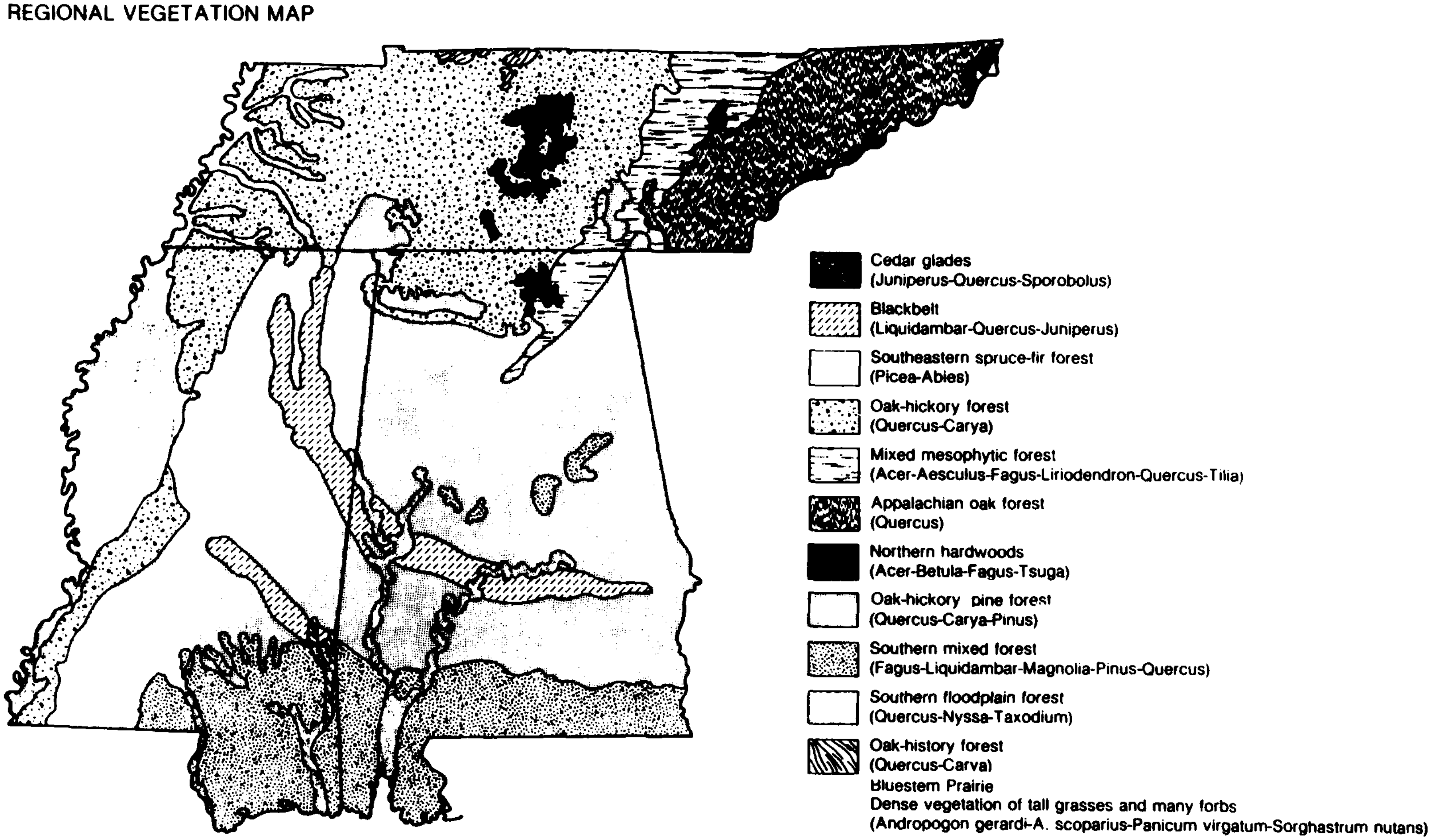


Figure 2. Regional vegetation map

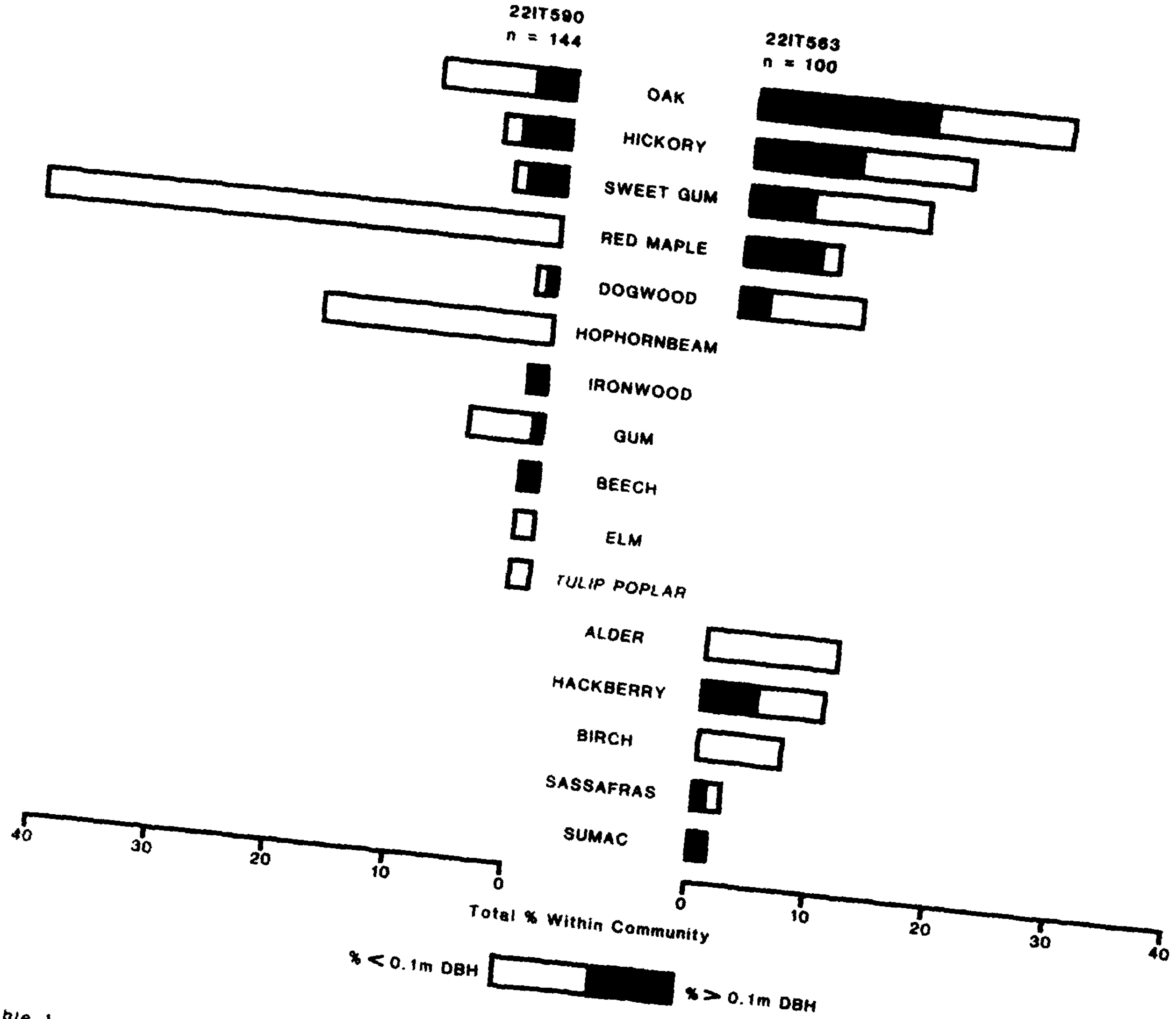


Table 1 Woody species composition of the formal vegetation plots, 22IT590 and 22IT576

primary forest. Secondary climax forests are made of the same species as the primary forest, although their composition and structure may differ. Consequently, studies of extant vegetation are useful when reconstructing prehistoric floral environments.

The fauna of the Upper Tombigbee Valley consists of a wide range of large and small mammals, birds, waterfowl, reptiles, and amphibians. The large expanses of bottomland hardwoods with intermittent oxbow lakes and streams provide ample cover for a great variety of species. Deer population is estimated at one per [illegible] acres. Squirrel populations are high with an estimated three per acre. Rabbit and quail populations in the area are good, with the quail being restricted to the more open areas. Furbearers such as beaver, muskrat, raccoon, bobcat, and fox are also abundant mammals. Turkeys are low in numbers in this region today, but would probably have been numerous in the past. The abundant oxbow lakes and sloughs together with hardwood timber stands, make this area attractive to migrating waterfowl and resident woodcock populations. In addition, morning doves, red-tail hawks, great horned owls, turkey vultures, and blue and green herons are examples of the larger bird species of the area.

The ecosystem supports a wide variety of reptiles and amphibians, many of which occur in high numbers. These include turtles, snakes, salamanders, lizards, and frogs. Fish present in the area include large populations of bass, bowfin, carp, catfish, gar, perch, shiners, and sunfish.

CULTURAL ENVIRONMENT

The results of the past 15 years of intensive archaeological efforts have documented a long and continuous human occupation of the Tombigbee Valley. The stages of development reflected in the archaeological record of this valley are the same as the rest of eastern North America (Table 2): Paleo-Indian ca. 15,000-10,000 B.P.; Archaic 10,000-3,000 B.P.; Woodland 3,000-900 B.P.; Mississippian 900-550 B.P.; and Historic 550 B.P. to present. (Alexander 1983a, 1983b; Bense 1982, 1983a, 1983b; Dye and Watrin 1985; Ensor 1981, 1982; Futato 1980, 1983; Jenkins 1981, 1982; O'Hear et al. 1985; Oakley and Futato 1975; Peterson n.d.; Walthall 1980, Weinstein 1981).

While a complete summary and integration of the culture history of the Tombigbee Valley is beyond the scope of this section, a synthesis of the known information will be attempted with more attention paid to the Paleo-Indian and Archaic stages, since they were the main focus of this study.

PALEO-INDIAN STAGE

The Paleo-Indian stage is the least understood portion of the aboriginal occupation in the Tombigbee Valley because of the lack of documented sites. This low archaeological visibility may stem from a relatively low population density or a subsistence/settlement pattern that resulted in widely scattered and briefly occupied camps. Alluvial burial or erosion by flood deposits could mask or eliminate cultural materials. The low frequency of identified Paleo-Indian sites likely results from a combination of all these factors.

Temporally sensitive Paleo-Indian artifacts, primarily projectile point/knives, have been recovered intermittently from the central valley near Gainesville, Al to the headwaters near Ryan's Well, Ms through the Divide-Cut in Tishimingo County, Mississippi to Tennessee. All finds appear to have been out-of-context. There have been surprisingly few specimens recovered in the Tombigbee Valley (less than 50 projectile point/knives) compared to the large number (thousands) that have been recovered from the adjacent middle Tennessee Valley.

TABLE 2
Chronological chart for the Upper Tombigbee Valley.

Date	Years	Stage	Period	Culture/ Variant	Phase
A.D.	B.P.				
1,735	265	Historic	Fully Historic		
1,540	450	Historic	Protohistoric	Burial Urn	Summerville IV
1,100	900	Mississippian	Middle	Moundville	Summerville II-III
650	1,340	Woodland	Late	Miller-Baytown	Miller III
B.C.					
100	2,000	Woodland	Middle	Miller	Miller I-II
500	2,500	Gulf Formational	Late	Alexander	Henson Springs
1,000	3,000	Gulf Formational	Middle	Wheeler	Broken Pumpkin Creek
3,000	5,000	Archaic	Late	Little Bear Creek	Beech
4,500	6,500	Archaic	Middle	Benton-Sykes White Springs	Walnut
6,000	8,000	Archaic	Middle	Eva/Morrow Mountain	Hickory
7,500	9,500	Archaic	Early	Kirk	Poplar
8,000	10,000	Archaic	Early	Dalton	Cochrane
10,000	12,000	Paleo-Indian	Late	Quad-Beaver Lake-Greenbriar	
11,000	13,000	Paleo-Indian	Middle	Cumberland	
12,000	15,000	Paleo-Indian	Early	Clovis	

The three Paleo-Indian stage periods established for the Southeast (Williams and Stoltman 1965; Dragoo 1973) are present in the Central and Upper Tombigbee Valley (Table 2): Early Clovis (15,000-13,000 B.P.); Middle Cumberland (13,000-12,000 B.P.); and Late Quad-Beaver Lake-Greenbriar (12,000-10,000 B.P.). The general lithic assemblage associated with these complexes includes a biface and a flake-and-blade technology which produced many distinctive artifacts such as fluted and eared projectile point/knives, uniface side and end scrapers, and flake-blade knives (Ensor 1982:16). Clovis period materials have been recovered from the central Tombigbee Valley in Alabama at Clear Lake (1Pi503) near Pickensville (Bense 1982; Muto and Gunn 1981), from four sites in the Gainesville Reservoir (Ensor 1982:16) and from the Mann site (22Ts565) in the Divide (Dye and Watrin 1985). The context of the central valley specimens appears to be disturbed. All were surface finds except Clear Lake. Two Clovis projectile point/knives were recovered from the Mann site in the Yellow Creek drainage. One was recovered from a sandy zone beneath the midden, but it appears that it was associated with later temporal markers (Dye and Watrin 1985:7-64, 7-68). The second Clovis was moved out of context by an amateur.

Only one site with a documented Cumberland period diagnostic marker was found: the Hickory site (22It621) in the Upper Tombigbee Valley (White 1983) located approximately 24 km (15 mi) north of Fulton, Ms in the floodplain. The Cumberland point was recovered from backfill, and no assemblage was recovered from excavations.

The latest Paleo-Indian period, Quad-Beaver Lake-Greenbriar, has been documented at several sites throughout the waterway. The only site, however, to produce a Quad projectile point/knife was the Poplar site (22It576) located in the Upper Tombigbee Valley approximately 9 km (5 mi) north of Fulton, Ms. This was a single point apparently out of context from a test unit (Bense 1982, 1983b).

While Beaver Lake and Greenbriar projectile point/knives have been recovered from sites throughout the waterway, there appears to be a pattern of increasing frequency in the upper valley, especially north of Fulton. Ms. Perhaps increased deposition and site burial downstream and very limited floodplain surveying and testing account for the dearth of these materials. Only one site (1Pi38) in the Gainesville Reservoir contained a single Beaver Lake projectile point/knife (Ensor 1982:17), and no sites contained Greenbriar projectile point/knives. While only one site (22It590) in the upper valley produced a Beaver Lake projectile point/knife (Bense 1983b), Greenbriar projectile point/knives have been recovered from ten sites. Three of these were in the central waterway between Amory and Aberdeen, Ms [22Mo569 (Brookes 1979), 22Mo710 (Bense 1982) and 22Mo819 (Rafferty et al. 1980)] and seven sites were located in the canal section: 22It576, 22It539, 22It590 (Bense 1982, 1983b; White 1983), 22It621, 22Ps542 (Bense 1983b) and 22Ts954 (Alexander 1983). It should be noted that Greenbriar and Beaver Lake projectile point/knife types are similar, and although a distinction has been made between them in classification, they can be considered to be variations on the same theme.

It appears that the Central and Upper Tombigbee Valley were occupied during the Paleo-Indian stage, but the archaeological remains are scarce, and there was an apparent preference for the upper valley, especially north of Fulton, Ms, during the latest period. Although Paleo-Indian sites were abundant in the Middle Tennessee Valley, only one Paleo-Indian site has been identified in the Yellow Creek drainage which is adjacent to the Upper Tombigbee Valley and in the Middle Tennessee Valley drainage. People of the Paleo-Indian stage were floodplain oriented in the Middle Tennessee Valley, but little use was made of the tributary valleys such as Yellow Creek.

ARCHAIC STAGE

The Archaic stage is well represented in the waterway with many sites identified in every section. From the initial surveys and testing in the waterway (Atkinson 1974; Blakeman 1975; Lewis and Caldwell 1972; Nielsen and Moorehead 1972; Rucker 1974), it was evident that the Tombigbee Valley contained a high number of Archaic sites. In addition, early on it was discovered that distinctive types of Archaic sites were present in the Tombigbee Valley: "midden mounds" (Atkinson 1974; Blakeman 1975; Rucker 1974). These mounds are deeply stratified Archaic deposits (1-2 m or 3.3-6.6 ft thick), some of which contain burials dating between 6,000-8,000 B.P. (Atkinson 1974; Blakeman 1975; Rucker 1974). Studies carried out since the early 1970s have shown that the Upper Tombigbee Valley was a major settlement area during the Archaic stage and that the midden mound site type extends from Columbus upstream to the headwaters in northeast Mississippi near Iuka.

The three periods of the Archaic stage which have been documented throughout the Southeast are present in the Tombigbee Valley: Early (10,000-8,000 B.P.), Middle (8,000-5,000 B.P.), and Late (5,000-2,500 B.P.). This division is supported in the chronologies of Bense (1982, 1983b); Dye and Watrin (1985); Ensor (1981, 1982); Futato (1983); Jenkins (1982); Oakley and Futato (1975); and O'Hear et al. (1985), although authors differ in the exact chronological placement of the periods.

The Early Archaic period has two sequential horizons: Dalton and Kirk-Big Sandy which are characterized by different projectile point/knife styles. This period is first signaled by the appearance of the Dalton assemblage. Dalton projectile point/knives have been documented throughout the waterway, but most contexts were disturbed. Four sites with intact components have been identified and investigated: the Hester site (22Mo569) near Amory, Ms, 1Gr1X1 and 1Gr2 near Gainesville, Al and the Colbert site (22Cl806) (Muto 1981). The Hester site provided the most information (Brookes 1979:30-31). It apparently was a hunting-butchering station as indicated by the large number of projectile point/knives and scrapers found (Brookes 1979:113-114). The site is located in the floodplain of the central Tombigbee River and was used at least twice during this period. The Dalton sites near Gainesville were only sampled (Ensor 1982:20-21) and though smaller than Hester, information from them confirmed the use of the bipolar reduction technique and thermal alteration for stone tool manufacture. All the in situ Dalton components were buried beneath alluvial sands on or near the present river channel. All occupations were interpreted as reflecting low density hunting and gathering groups, similar to the settlement pattern interpreted for the Paleo-Indian stage. The Dalton occupation of the Tombigbee Valley could well be part of the Red Hill phase defined by Walthall (1980:48) for northern Alabama.

The best known of the Early Archaic horizons is the Kirk-Big Sandy, and it has been documented for all areas of the waterway. While there are more sites identified in the upper valley north of Fulton, Ms, the sedimentation and survey problems previously noted likely effected the low number of sites identified downstream. It is interesting that the Hester site stratigraphy indicated that the Big Sandy horizon followed the Dalton and preceded the Kirk occupation (Brookes 1979:51-54,109). In addition, the Kirk (or Pine Tree) was separated from the Big Sandy by a series of stemmed point types. This has not been confirmed in subsequent investigations in the waterway. In the Kirk and Big Sandy components that have been investigated in the central valley the numbers of Big Sandy projectile point/knives has been too low, or the stratigraphic relationship to the corner-notched types has not been determinable. Many Early Archaic components have been investigated in the upper valley including seven of the sites reported here along with many sites in the Divide-Cut (O'Hear et al. 1985). In all these investigations, there has been no clear documentation of a Big Sandy horizon below the Kirk horizon as was the case at the Hester site.

In the floodplain of the upper valley there is an association between the Kirk and Greenbriar projectile point/knife types early in the Kirk horizon, although Kirk quickly becomes the preferred style (Bense 1983a, 1983b; White 1983). There appears to have been an erosional episode at places in the upper valley just prior to the Kirk occupation, possibly dated at 9,030±340 B.P. (Alexander 1983b). This could explain the lack of Paleo-Indian, Dalton, and Big Sandy components in this area.

The Kirk occupation as seen in these upper valley sites reflects short-term occupation associated with hunting, stone tool manufacturing, and food processing. Features include pits, possible postmolds, and clusters of lithic debris from manufacture and repair. The use of the upper valley and divide during the Early Archaic seems to have been heavy, as indicated by the high density of Kirk sites in the Canal and Divide-Cut Sections (Bense 1982, 1983a; O'Hear et al. 1985).

The Middle Archaic period (8,000-5,000 B.P.) has been well studied in the Tombigbee Valley. Alexander (1983b:214-230) summarized much of the information. However, there has been no thorough summary or interpretation of these works, and the information is available only in government reports. Therefore, a brief summary and interpretation of the information on the Middle Archaic in the Tombigbee Valley is included here. A much more detailed integration of the information is possible and should be performed.

The primary temporal markers for the Middle Archaic (Eva/Morrow Mountain, Sykes, White Springs, Benton and possibly Ledbetter) have been identified throughout the waterway. The Middle Archaic assemblages south of Aberdeen, Ms appear to be linked to the Coastal Plain Archaic tradition in both stylistic markers as well as lithic raw material. The assemblages north of Aberdeen appear to be tied to the Tennessee Valley Archaic tradition (Ensor 1982:24-25). The most important aspect of the Middle Archaic is that the adaptation to the valley changed during this time period. The settlement pattern changed from a series of relatively homogeneous small encampments at many locations to large base camps with small satellite camps.

The organization of Middle Archaic settlements throughout the waterway is characterized by base camps which are in or overlooking the floodplain with smaller sites located in the surrounding floodplain, terraces, and uplands. Waterway investigations of the Middle Archaic period have centered on the base camps (Alexander 1983a; Atkinson 1974, 1980; Bense 1983b; Binkley 1978; Blakeman 1975; Dye and Watrin 1985; Otinger et al. 1982; Rafferty et al. 1980; White 1983). Other such base camps have been identified in the Tennessee Valley drainage (Parker 1974) as well as in the Tuscumbia drainage (Alexander 1983b; Weinstein 1981). The smaller sites received less attention and also generally had less integrity, with most being located in plowed fields (Bense 1983a; Blakeman 1975, 1976; Blakeman et al. 1976; Rucker 1974). Therefore, most of what is known about the Middle Archaic is from base camp investigations.

The Middle Archaic shift in settlement pattern appears during the initiation of the Eva-Morrow Mountain/Vaughn-Demopolis horizon ca. 8,000 - 7,500 B.P., when occupation intensified at certain previously occupied floodplain sites, and the use changed from temporary camps to long-term base camps. Seventeen such sites have been identified in the 150 km (100 mi) long area from Columbus north to Iuka and Corinth, Ms. The northernmost four are within a 22 km (15 mi) radius in the headwaters area of Mackey's Creek, Yellow Creek, and the Tuscumbia River in extreme northeast Mississippi. Five additional midden mounds have been identified in the 30 km (20 mi) stretch down Mackey's Creek and the East Fork of the Tombigbee to Fulton, Ms. These sites are 22Ts954 (Alexander 1983b), 22It590, 22It539 and 22It576 (Bense 1983a, 1983b), and 22It621 (White 1983). There are no midden mounds identified in the 38 km (25 mi) stretch of the Tombigbee between Fulton and Amory. 22Mo710 (Bense 1982) is likely a midden mound, and is located just below Amory. Three midden mounds have been identified near Aberdeen, Ms, ca. 22 km (15 mi) downstream from Amory. One has been excavated (22Mo819: Rafferty et al. 1980), one has been tested (22Mo752: Bense 1982), and one has been surveyed only (22Mo747: Atkinson and Elliot 1978; Blakeman 1975). Four midden mounds have been identified in the next 35 km (25 mi) stretch of the Tombigbee between Aberdeen and Columbus, Ms and are the southernmost midden mounds identified. The Vaughn Mound (22Lo538) was tested by Atkinson (1974) and produced the first early date (6660±95 B.P.) from the midden mound site type. The Kellogg Mound (22Cl528) was tested by Blakeman and produced another early date (8600±685 B.P.) (Blakeman 1975:96). The Kellogg Village (22Cl527) was tested by Blakeman (1975:26-39) and later excavated by Atkinson et al. (1980). The Barnes Mound (22Lo564), the southernmost mound, was also tested by Blakeman (1975:75-94).

The change in settlement pattern during the Middle Archaic at the midden mound base camps is reflected in the build-up of a dark, organic midden, an increase in site features and site facilities. Possible structural remains have been identified in several of these sites: Brinkley (22Ts729) and Mann (22Ts565) in the upper valley and East Aberdeen (22Mo819) in the central valley. The investigation reported here documented complex prepared areas which were centers of activity and had at least one and often several hearths at three sites in the upper valley: Ilex (22It590), Walnut (22It539), and Poplar (22It576), as well as an additional site nearby (22Ts943). Burials were interred at some of these sites in both the flexed and extended positions. Several cremations have also been documented. A "cemetery" with graves ordered in rows and more than one extended body in each grave was also encountered in the upper valley (22It539) by the investigations. Not all midden mounds have all these features or facilities. This is likely due both to differing levels of investigation and the range of variation in aboriginal site use. From all evidence, these sites became the focal points of activity early in the 3,000-year period of the Middle Archaic. This trend climaxed in the Benton culture.

As noted above, there is little known of the satellite camps. One was investigated in this study (22It623/22It624), and the results indicate that the site was used more intensively during the Middle Archaic than in previous periods. For example, the use of large storage and refuse pits was initiated at the site during this time. Despite increase in use, evidence indicates fewer inhabitants and a narrower range of activities than at the midden mound base camps in the vicinity (22It539 and 22It621).

Differing tradition affilitations (Coastal and Tennessee Valley) of the populations in the valley and divide has permitted the development of an accurate chronology, but there are some differences in the stylistic markers and assemblages within the Tombigbee Valley. Upstream from Aberdeen, the settlement change occurred during the Eva/Morrow horizon ca. 7,000 B.P. and by the time of the Sykes-White Springs culture permanent site facilities have been documented. Downstream from Aberdeen, the Vaughn horizon settlement pattern changes. Typical midden mound site facilities and burials are documented by the following Sykes horizon. Throughout the entire area, the Benton culture marks the floresence of this period and the use of the midden mound site type.

Little detailed information is available about the Late Archaic period (5,000-3,000 B.P.) in the Tombigbee Valley. This contrasts greatly with what is known of the Middle Archaic. Few intact Late Archaic components have been identified and investigated in the waterway, primarily because of disturbance. Markers for this period (Ledbetter, Pickwick, and Little Bear Creek projectile point/knives) have been found throughout the valley and divide, indicating continued use of the area. However, the pattern of settlement appears to shift from the midden mound base camps to a more dispersed settlement pattern akin to that which preceded the Middle Archaic phenomenon. At least one intact component of the Late Archaic period has been investigated, 22It623/22It624, and it is reported in this document. This period is better known in the Tennessee drainage, especially in the Little Bear Creek and Cedar Creek valleys (Futato 1983; Oakley and Futato 1975). Cultural continuity between the Middle and Late Archaic periods is seen in all investigations. However, large base camps, with a plethora of pits, hearths, prepared areas, and burials, appear no more in the Tombigbee Valley. The thick midden build-up during the Late Archaic in the midden mounds is evidence of heavy occupancy. Although no undisturbed Late Archaic midden mounds were found, there were no hearths, prepared areas, or burials in the midden mounds during this time.

GULF FORMATIONAL STAGE

Approximately 3,000 B.P. ceramics were introduced to the mid-South. Wheeler fiber-tempered ceramics came first, and they were soon followed by the Alexander sand-tempered series (Jenkins 1978, 1981, 1982). Some authors include the period of the appearance of these ceramics in the Late Archaic period (Alexander 1983b), but most accept Jenkins and Walthall's (1976) Gulf Formational stage as an intermediate one between the Archaic and Woodland in the Coastal Plain. The Middle and Late periods of the Gulf Formational stage have been consistently documented throughout the waterway and surrounding areas. The stage is initiated in the waterway by the appearance and exclusive use of Gulf Tradition ceramics and concludes with the appearance of ceramics derived from the northern, middle eastern, and southern Appalachian traditions (Jenkins 1982:49).

The Wheeler culture (3,000-2,500 B.P.) is found throughout the western portion of the Southeast, but the majority of the sites and the apparent development area is in the Western Tennessee Valley and is termed the Bluff Creek phase (Jenkins 1974, 1975). Sites of this culture are frequenty in the Upper and Central Tombigbee Valley where the local phase is called the Broken Pumpkin Creek phase (Jenkins 1974, 1975a, 1975b, 1982; Walthall and Jenkins 1976). Although Wheeler sites are found throughout the Central and Upper Tombigbee Valleys, the frequency increases in the northern portion.

Wheeler ceramics are characterized by fiber tempering and a simple bowl form which is either plain or punctated. Simple stamped and dentate-stamped designs were added between 2,800 and 2,600 B.P. (Jenkins 1981, 1982; Jenkins and Krause 1986; Walthall 1980:89-91). The stylistic projectile points are characterized by broad blades and incurvate, horizontal shoulders which show similarities with Late Archaic types and are associated with bifacially chipped stone tools, expanded base drills, and a variety of bone and antler implements. Ornaments include ground stone and expanded center-perforated bar gorgets (Ensor 1982; Walthall 1965, 1980; DeJarnette, Walthall, and Wimberly 1975). The Central and Upper Tombigbee Valley Wheeler populations traded for Tallahatta quartzite and ceramics from the Bayou la Batre culture to the south and steatite and sandstone from the Bluff Creek phase to the north.

Walthall (1980) and Dye (1977, 1980) characterize the Wheeler settlement pattern by floodplain occupation in the warm months and upland hills occupation in the cooler months. Subsistence remains excavated from the western Middle Tennessee Valley (Dye 1980:228-231) include: white-tailed deer, rabbit, squirrel, and other small mammals, box and soft-shelled turtle, snakes, freshwater drum, catfish, hickory nut, weed seeds (including chenopod), grape, walnut, and acorn.

The following Alexander culture (2,500-2,000 B.P.) also developed in the western Middle Tennessee Valley and the headwaters of the Tombigbee River. In the Tennessee Valley the local expression of Alexander is called the Hardin phase (Dye 1973), and in the Upper and Central Tombigbee Valleys it is known as the Henson Springs phase (DeJarnette et al. 1975; Jenkins 1979, 1981, 1982; Walthall 1980).

The separation of Alexander from the earlier Wheeler is based on changes in ceramics. This includes design motifs, ceramic temper (from fiber to sand), and vessel form changes. New vessel shapes included globular and vertical-sided bowls, flat-based beakers or cups and some exotic "boat" shapes (Atkinson et al. 1980). Decorations included incising, zone stamping, and an elaboration of punctation (Jenkins and Krause 1986:35). The Alexander ceramic attributes are similar to other contemporary Gulf Coast ceramic complexes such as Tchefuncte, Orange, and Bayou la Batre, and to the earlier Wheeler horizon. A detailed modal attribute study of the Alexander ceramic assemblage was performed by the investigators on the isolated assemblage at the Aralia site. Vessels commonly have podal supports or annular notched bases and a variety of rim treatments, including fabric impressing, incising, punctating, notching, stamping, and nodes. The lithic assemblage continues relatively unchanged from Wheeler and has been isolated only at the Aralia site (Bense 1983b).

In the Tombigbee Valley, Alexander sites have been recorded from the floodplain and uplands (open sites and bluff shelters) (Rucker 1974; Atkinson et al. 1980; Bense 1982, 1983b; DeJarnette et al. 1975; O'Hear et al. 1985). Subsistence evidence is meager, but the presence of freshwater drum, hickory nut, walnut, acorn, grape, persimmon, and weed seeds (Dye 1980) suggests the continuation of previous subsistence pursuits.

Most of the many sites of the Wheeler and Alexander cultures identified in the waterway have been disturbed. Three intact components in the Upper Tombigbee Valley and Divide have been investigated: Aralia (22It563) (Bense 1983b), Turtle Pond (22It643) (Thomas et al. 1982), and the Mann site (22Cl806) (Dye and Watrin 1985). In addition, the Yarborough site (22Cl814) in the central valley (Solis and Walling 1982) also contained an intact Alexander component. However, the high number of both Wheeler and Alexander sherds in the mixed deposits of the other sites, especially the midden mounds, points to a full but unknown pattern of use in the valley.

WOODLAND STAGE

The Woodland stage is well represented in the waterway. In fact, most sites encountered contained materials from this stage. In the upper valley and divide-cut these deposits usually had been disturbed by cultivation or amateur digging. Most of the cultural information from this stage in the valley has come from the central valley south of Aberdeen, Ms (Atkinson et al. 1980; Jenkins 1981, 1982; Jenkins and Krause 1986; Ensor 1981, 1982). The beginning of this stage is ca. 100 B.C. when the Gulf Ceramic Tradition rather abruptly ended and was replaced by the northern-derived styles such as cord marking and fabric marking. The middle period (100 B.C. - A.D. 650) is designated as the Miller I phase of the Miller culture (Jenkins 1979, 1981; Jennings 1941, 1944; Walthall 1980) and has been divided by Jenkins (1981, 1982) into three subphases based on ceramic attributes. Jenkins (1982) gives an excellent description of the current knowledge of this phase that will not be repeated here. Instead, the primary characteristics and distribution of this phase throughout the Upper Tombigbee Valley waterway will be briefly presented.

The Miller culture in the Upper Tombigbee Valley began ca. 100 B.C. and continued for about 1,000 years. Mortuary ceremonialism in the upper valley is represented by several burial mound sites, such as the Bynum Mounds (Cotter and Corbett 1950), the Pharr Mounds (Bohannan 1972; Kardwedsley 1980), and the Dogwood Mound (Bense 1983b) located both on small creeks and the main stream. The Bynum site was a village associated with six mounds in the headwaters of the Tombigbee. It contained nine houses (17-18.5 m or 56-61 ft in diameter) associated with flexed burials, fire pits, and shallow storage, or trash pits. Another Miller I mound center, the Pharr Mound, also in the Tombigbee headwaters included excavated and prepared pits to receive the cremation or extended/flexed inhumation. Charnel houses were constructed over these excavated pits, and small logs were then placed around the grave. After the charnel house or hut was burned, mortuary offerings were placed with the body, and a mound was then built over the grave. Many Hopewellian ritual goods have been associated with the cermonialism at these sites documenting a strong participation in the Hopewellian Interaction Sphere.

Several Middle Woodland middens have been investigated including the Strickland site (22Ts765) (O'Hear and Conn 1978), 22It581 (Bense 1983a), the Brinkley site (Otinger et al. 1982) the Mann site (Dye and Watrin 1985), and several other sites in the divide (O'Hear et al. 1985). It appears that small villages or camps were scattered throughout the Tombigbee drainage. Many of the Miller I sites were established on earlier Wheeler and Alexander sites.

Village middens from this period often include refuse pits, hearths, and even earth ovens. Structures were recovered at the Miller site (Jennings 1941) and were either oval or elliptical (4.5x5.4 m or 15-18 ft) or subrectangular (5.8x6.4 m or 19-21 ft), and storage or refuse pits were often found within them. One flexed burial was recovered from inside one of the structures. Numerous shallow pits were encountered in the site midden. Subsistence evidence includes hickory nut, acorn, and walnut (Caddell 1979:56). The subsistence pattern appears to represent a continuation of Archaic and Gulf Formational stage hunting, gathering, and fishing.

During the Miller II phase of the Middle Woodland sites become more concentrated in the central valley Black Prairie Belt (Jenkins 1981, 1982). Burial mounds continued to be constructed, and burials were no longer in the village middens. The absence of burial goods indicates a cessation of active participation in the Hopewellian Interaction Sphere. Excavated sites in the central valley include 1GR1x1 (Nielsen and Moorehead 1972:29-44), 2GR2 (Jenkins 1975:56-158; Nielsen and Jenkins 1973:54-88), and 1PI61. A late Miller II structure, measuring 8x11 m (26.5-36 ft) in diameter, has been excavated at Site 1GR1x1 with a central oven 1.5 m (5 ft) in diameter.

While the Late Woodland period (A.D. 650-1,100) has been encountered in all areas of the Tombigbee Valley and Divide, it appears that populations were concentrated in the central valley below Columbus and that the upper valley was peripherally used. Jenkins (1981, 1982) has described this period in detail in the central valley and divides the Miller III phase into four subphases based on ceramic typology. This Late Woodland phase is marked by the introduction of clay as a dominant ceramic-tempering agent and by the presence of a bow-and-arrow technology. A microtool assemblage was also established at this time. Small chert flakes were frequently used as knives, and pebbles were often chipped into scrapers. Other lithic tools include flake perforators and drills.

Subsistence practices of hunting, gathering, and fishing continued, however, the use of corn is first substantiated during this period (Caddell 1979:56-57). The frequency of corn suggests that it was never a major carbohydrate source in the Late Woodland diet. Although corn was present, wild plants were the staples. In addition, larger numbers and an increased variety of seed from herbaceous annuals are present in Late Woodland contexts, suggesting extensive clearing.

Although, white-tailed deer seem to have constituted the primary meat source throughout much of the Woodland period, the use of this animal declined through time. Beginning with the latter portion of the Middle Woodland period, deer exploitation gradually decreased, while the exploitation of other mammals, fish, turtles, and shellfish increased, reaching a peak by the end of the Late Woodland period. Throughout the remainder of the Late Woodland period, the dependency upon other vertebrates and invertebrates continued to increase.

During the last 100 years of this period, shell-tempered pottery was manufactured, although in minor amounts. The same grog-tempered types continued to be manufactured as were the Madison arrow points. Small, semi-subterranean, rectangular structures appeared at the end of the Late Woodland. Burial position changed from a tightly flexed inhumation with no consistent orientation to semi-extended burials placed on the back or side with the head oriented to the east. Sexual dimorphism decreased during the transition from Late Woodland through Late Mississippian times, and burial treatments indicate a change from egalitarian to non-egalitarian, and then a return back to egalitarian forms of interment. This may indicate changes in social status and social organization (Hill 1979:252-253).

In the upper valley, many Late Woodland sites have been found, although most deposits have been mixed due to amateur digging and cultivation (Bense 1982). Most sites are small though, with no large complex villages as in the central valley. One Late Woodland component with integrity has been excavated, 22It606, and it is reported here.

This site on a high terrace edge overlooking the floodplain had several pit features and a dominance of grog-tempered ceramics with only minor amounts of bone and shell tempering. Four features were dated containing this ceramic assemblage; the dates ranged from A.D. 1,170-1,440 (White 1983:348). This late date may reflect either a shift of the upper valley population to the better agricultural lands near Tupelo, to the Black Prarie to the south, or a relatively isolated population which remains in the Late Woodland stage of cultural development and does not participate in the Mississippian culture.

MISSISSIPPIAN STAGE

This stage of cultural development is present primarily in the central valley near, Aliceville and Gainesville, Al. Jenkins (1981, 1982) and Peebles (1983) provided a detailed description which will not be repeated here. The Moundville ceramics are characterized by shell tempering with designs and vessel shapes changing through time. This ceramic tradition arrives as a developed complex, rather than developing out of the previous Woodland period (Jenkins 1979, 1982, 1983; Peebles 1983; Steponaitis 1980:174-186, 1985).

During the entire Mississippian stage the predominant arrow point style is the small triangular type (Ensor 1982), particularly the Madison type. A variety of shell artifacts were manufactured during this stage primarily for decorative ornaments. Bone artifacts also continued to be manufactured from turkey and mammals, for both decorative and utilitarian uses.

Faunal remains associated with Mississippian sites in the Central Tombigbee Valley are dominated by the white-tailed deer, but also include mammals, turtles, and fish (Woodrick 1979:157). Woodrick also notes during Mississippian times the continuing decline of the white-tailed deer and the concomitant increase of other faunal food sources increased.

Corn remains increased, but hickory nuts are still prominent. Corn was probably a main, if not the main, carbohydrate base of the diet during the

Mississippian period, but hickory nuts and acorns were still a part of the diet (Caddell 1979:67).

The Upper Tombigbee Valley seems to have either been sparsely occupied by Mississippian people, or was well occupied by Late Woodland culture practicing people. Mississippian villages existed in the area outside the Tombigbee Valley in the Tupelo Hills, but they have not been investigated as well as those in the Tennessee Valley.

SUMMARY

This project was conducted in the headwater area of the Upper Tombigbee Valley in northeast Mississippi. This area is characterized by deeply dissected, sandy terrain and a wide, swampy floodplain. Much recent archaeological work in the Tombigbee Valley was spawned by the Tennessee-Tombigbee Waterway. Most information produced has been from the Woodland and Mississippian stages. A detailed chronology has been established, and knowledge of the lifeway of these stages is also quite detailed. Much less is known of the Archaic and Gulf Formational stages. This was the focus of these investigations. The culture history presented here served as the foundation of the project research design, which is enunciated in the next chapter.

CHAPTER III RESEARCH DESIGN

The continuing focus of this research has been to determine the nature of hunter-gatherer adaptations to the Upper Tombigbee Valley during the Archaic stage. The research design has had two major stages of development. The first stage was the establishment of the theoretical perspective and methods for data recovery (Phases I and II) based on information from testing four of the sites (Bense 1982) and the information available from other similar midden mound sites. The second stage of research design was developed after preliminarily analysis was performed on the recovered material. Models of the paleoenvironment and archaeological/cultural patterns in the Upper Tombigbee Valley were developed based on this analysis, and certain hypotheses were tested in the final phase of the project.

INITIAL RESEARCH DESIGN DEVELOPMENT

The initial research stemmed from the results of testing three midden mounds which had thickly covered, undisturbed Archaic deposits and one single-component middle Gulf Formational (Henson Springs) deposit. These sites were considered together to orient research primarily toward the Archaic and Gulf Formational way of life in the Upper Tombigbee Valley. Three other midden mounds were later (1981) identified, investigated, and included in this project (22It621, 22It623, and 22It624).

The nature of the archaeological remains dictated that emphasis was centered on the economic activities of the Archaic hunters and gatherers. Although efforts were made to analyze organization (community plan, mortuary customs, and status) and ideology, these proved to be more difficult to address, because the data needed to confirm relevant hypotheses proved to be scarce and obscure in the archaeological record.

A complementary focus was to establish a chronological framework for the Upper Tombigbee Valley. Although previous surveys, tests, and excavations were conducted, the resulting chronologies were developed without the benefit of multiple stratigraphic sequences and dated materials. The midden mounds, with deeply buried Archaic deposits, had the potential to provide accurate dating. A refinement of the chronology was essential to an understanding of prehistoric behavior and adaptation.

This research was guided by the economic models of hunters and gatherers, which were based on generalizations derived from ethnographic and ethnoarchaeological studies. The studies of Jochim (1976), Binford (1980), Yellen (1977), and Thomas (1979) attempted to assemble observed cross-cultural regularities in economic goals and behavior to generate a set of regularities about the nature of a hunting and gathering economy. If these regularities hold regardless of space or time, then they should be useful in explaining the actual patterns documented in the archaeological record.

The regularities observed by most researchers of hunting and gathering societies are as follows:

1. Economic behavior is the result of conscious choice. Selection of usable resources, decision as to their proportional use and time of utilization, and demographic and spatial arrangements chosen in order to accomplish the exploitation, all use human time and energy. These decisions structure subsistence and settlement patterns. Hunters and gatherers often expend small amounts of energy in the food quest; allotment of the expenditures depends on the available choices among competing or mutually exclusive activities.

2. Resource selection is deliberate rather than a random or opportunistic utilization of resources. Local, temporal, and spatial variations of resources are present in all hunting and gathering societies, but it appears that opportunistic utilization is a conscious decision to alter the usual patterned activities.
3. Decision-making process is rational and is appropriate for understanding the roles of choices and decisions made by hunters and gatherers.
4. Uncertain outcome probabilities must be estimated, because the exact probabilities of the consequences of economic choices are not known. At best they are estimated from previous experience and new information. This reduces risk - the decision to a partial uncertainty.
5. Choices are made to satisfy predetermined aspiration levels. Alternative choices or competing objectives are considered, and an order or preference is established. This is important, because it incorporates decisions which include procurement of generally nonedible items (hides, antler, and bone) and deals with conflicting goals or objectives.
6. Resource scheduling uses a mixed strategy solution to competing resource availability. This combines several options, such as simultaneous performance of more than one activity, simultaneous exploitation of more than one location or area, or sequential change of activities and locations.

The desire to limit effort underlies all economic decisions and is an important goal that guides the economic behavior of hunters and gatherers. Minimization of effort (mini-max theory), or the keeping of effort within a predefined range, crosscuts all studied groups.

The decision-making processes of hunters and gatherers are a result of resolving specific interrelated problems between man and the natural environment. This relationship is the most important factor conditioning the economic behavior of hunters and gatherers. When these relationships are considered in a systemic framework, it is called the ecological approach. Human ecology considers a human population as part of the ecosystem (Steward 1955) and focuses on the structural relationship of a group to its natural environment. The approach of ecology provides a structure for the focus and priority of exploitive activities, and it uses the concepts of ecological theory such as adaptation, stability, diversity, and trophic level.

With this knowledge of hunter-gatherer economies, organizational principles, and resource use scheduling developed by anthropological studies, this research was designed to apply it to this investigation of prehistoric hunters and gatherers in the Upper Tombigbee Valley. Therefore, it is within the framework of cultural ecology that the collection strategies, analyses, and interpretations were designed.

REFINED RESEARCH DESIGN

The above general principles and orientation guided data recovery and analyses in the first two phases of the project. The collection strategy, which will be described in the subsequent chapter, was based on economic principles, and chronology was established by utilizing flotation to address subsistence, detailed soil analysis for traces of organic matter, large block excavations to reveal site facilities, and frequent dating of the cultural features and deposits. Preliminary analyses, coupled with additional new information from other geoscience and archaeological studies in the the Tombigbee Valley, provided multiple lines of evidence for first-stage models of both the paleoenvironment and cultural patterns of the Upper Tombigbee Valley. These models incorporated apparent correlations between the Holocene environmental shifts and cultural behavior as seen in site use, material assemblage, and depositional units. These models suggested research questions, and subsequent hypotheses were constructed and tested. These first-stage models constructed in 1983 from the results of Phases I and II are described in the following sections.

PALEOENVIRONMENTAL MODEL

The geoscience data from this and other projects provided important information on the evolving landscape in the Upper Tombigbee Valley. Preliminary analysis indicated the following Holocene sequence of climatic and depositional events.

A dynamic environment with unstable land surfaces characterized the Late Pleistocene and Early Holocene (16,000-8,000 B.P.). The Tombigbee was probably a braided or coarse-grained meandering stream, and floods were probably of a greater magnitude but with less frequency than during the previous Pleistocene period because of a greater suspended sediment load. There was little surface stability in the floodplain with more open ground and less vegetation in the first part of this period. Typical floodplain topographic features included distributary channels, braided channels, streams, and gravel-sand bars.

The temperature appears to have been cooler than during the remainder of post-glacial climate, and there was more episodic rainfall of greater magnitude than before or since with drought conditions probably occurring in winter and late summer. The presence of maples in the pollen record of the forests indicated to Muto and Gunn (1985:6-9) that adequate growing season moisture (spring-summer) was available.

A period of stability followed during which the basal Early Holocene sediments developed in some areas into a mid-Holocene soil, which is locally preserved. Radiocarbon and archaeomagnetic dating place this period of landscape stability between 5,000 and 8,000 B.P. Deposition in the floodplain was reduced towards a xeric peak between 5,000 and 6,000 B.P. This mid-Holocene period corresponds to the Altithermal or Hypsithermal climatic episode originally defined by Antevs (1962) and later identified throughout the Northern Hemisphere.

More mesic conditions ensued approximately 5,000 B.P., and deposition resumed in the floodplain. The Tombigbee initiated down-cutting during this period in response to a drop in sea level during a period of cooling. A mesic hardwood forest was established during this period (Muto and Gunn 1985:6.11)

In sum, the paleoenvironmental model of the Late Pleistocene and Holocene for the Tombigbee Valley had three basic episodes: cooler and more moist (16,000-8,000 B.P.), warmer and probably drier (8,000-4,000 B.P.), and present conditions (4,000-0 B.P). This model has been evaluated in this study of the past cultural systems of the Upper Tombigbee Valley.

ARCHAEOLOGICAL MODEL

During the Early and initial Middle Archaic (Kirk through Eva-Morrow Mountain: pre-7,000 B.P.), the sites appeared to have been intermittently occupied. The archaeological material had a low cubic volume ratio and consisted of chipped stone tools and debitage. Assemblages were occasionally separated by several centimeters of sterile soil. Site features of this period included lithic debitage concentrations and only three pits. No site facilities, such as structures or hearths, were encountered in these deposits and short-term occupations were inferred. The Ilex site (22It590) had the darkest midden for this period, as well as the highest number and density of cultural material, and it could have been a longer term or more intensely occupied locality. The primary lithic raw materials were heat-treated cobbles of local cherts modified by bifacial reduction. A few projectile point/knives, drills, and other small, refined tools were made of a better quality imported chert. One Eva/Morrow Mountain burial was also encountered.

Between 7,000 and 5,000 B.P. (Sykes-White Springs and Benton) use of these sites changed significantly. The material record consists of abundant charcoal and broken fired clay, increased density of cultural material, tightly clustered residential areas with complexes of features including prepared clay areas with multiple hearths associated with residential activity, storage pits, refuse pits, and many burials. One site (22It539) of the Sykes-White Springs/Benton occupation had two distinct "cemetery" areas with graves ordered in rows, often with multiple individuals (2-3) in the same grave in the extended, prone position.

The lithic raw material, stone tool assemblage, and technology used during this intense occupation of the floodplain was also different from the preceding occupations. The primary lithic raw material used for tools was Fort Payne chert, which was imported in the form of prepared bifaces. This pattern of importation contrasts sharply with the preceding pattern of utilization of local cherts. The Benton occupation also appeared to have a narrower range of tools, dominated by the large projectile point/knife, which were apparently, multipurpose tools.

Several lines of evidence suggested that the Benton sites were used as year-round or at least as semipermanent base camps. Dating of the four residential areas indicated that they were used between ca. 6,300 and 5,300 B.P., probably during the first part of the Altithermal period.

Occupation of the sites continued after the highly concentrated Sykes-White Springs/Benton occupation. However, some aspects of site use changed. Features such as the prepared areas and hearths disappeared. The most frequent feature encountered was the refuse/storage pit. The material culture of the Late Archaic resembled the pre-Benton period.

Site disturbance plagues the archaeologist who seeks an understanding of the post-Benton occupations in the Upper Tombigbee Valley. While all sites investigated had been occupied during the Late Archaic, Gulf Formational, Woodland, and Mississippian stages, only two intact components were present from these periods. It does appear, however, that the Late Archaic cultural tradition persisted in the UTV.

The middle Gulf Formational (Henson Springs) culture (ca. 3,000-2,000 B.P.) had distinctive ceramics, and it apparently interacted with the Middle Tennessee Valley people. Production of these ceramics appears to have begun and ended rather abruptly. The fabric- and cord-marking tradition which followed during the Middle Woodland persisted for a relatively long time (ca. 2,000-700 B.P.). The Late Woodland stage apparently extended well into the accepted time period of the Mississippian stage documented in the nearby areas of the Tupelo Hills and Central Tombigbee Valley.

CORRELATION IN PALEOENVIRONMENT AND ARCHAEOLOGICAL/CULTURAL PATTERN

The archaeological record at most of the sites consisted of three recognizable components of the Archaic stage: 1) Early to initial Middle

Archaic (ca. 12,000-7,000 B.P.) with light and separate concentrations of lithic tools and debitage, only a few features, and little organic staining, 2) terminal Middle Archaic (7,000-5,000 B.P.) of dense, clustered artifacts with residential features, cemeteries, hearths, storage and refuse features, and dark, organically stained charcoal-rich soil, and 3) Late Archaic (5,000-3,000 B.P.) deposits with fewer artifacts, refuse, storage, and occasional burial features. Occupation types appeared to correlate with the depositional and soil formation episodes: the paleosol contained Early Archaic (Greenbriar, Big Sandy, Kirk) and some initial Middle Archaic (Morrow Mountain, Eva) components. The terminal Middle Archaic (Sykes-White Springs/Benton) component was in a dark midden zone resting uncomformably on the paleosol. The disturbed post-Benton, terminal Late Archaic deposits were situated at the base of the dense, organic epipedon.

ADDRESSABLE CULTURAL PROCESSES

Three cultural processes supported by models of environmental dynamics, cultural behavior, the economic regularities of observed hunters and gatherers and the data could be addressed in the final phase of the project:

1. Initial settlement dynamics
2. Cultural evolution
3. Transition to Late Archaic

PROCESS 1: INITIAL SETTLEMENT DYNAMICS

The Upper Tombigbee Valley was apparently initially occupied by the late Paleo-Indian populations after initial settlement of the Middle Tennessee Valley floodplain in the Early Paleo-Indian (Clovis) period. The settlement of the Tombigbee Valley apparently progressed in a north-to-south direction during the Late Paleo-Indian and Early Archaic periods. The materials recovered from four floodplain sites in this project (22It539, 22It576, 22It590, and 22It621) contained assemblages of these periods. These assemblages, identified by temporally sensitive projectile point/knives, are of the Late Paleo-Indian, Dalton, and Early Archaic periods. The assemblages consist of a wide variety of large and small chipped stone tools, debitage, and groundstone. In addition, three pit features and six chipped stone clusters were associated with these components. The integrity of these deposits was good, and meaningful associations appeared to have been preserved in the cultural material. Preliminary analysis indicated that there were similarities in features and assemblages which crosscut the sites, as well as differences among them. From these preliminary observations the following first-generation hypotheses and test expectations of the early occupation of the upper valley were constructed.

Hypothesis 1: The adaptations of the initial settlers to the environment of the Upper Tombigbee Valley became increasingly refined through time, reflecting an increasing knowledge of the environmental resources available and methods of exploiting these resources.

Test Expectations

1. The tool assemblage and technology during initial occupation will be initially homogenous and increase in diversity through time as a result of

local adaptation, distance from origination, isolation, and evolutionary processes.

2. Individual site use should become more differentiated through time, with increased knowledge of the area due to the differential distribution of raw materials and other natural resources.

3. Specialized tools and weapons of high importance in food acquisition and production of necessities (projectile point/knives, scrapers, drills, hammerstones) will be made of the highest quality raw material accessible by quarry or trade, will be manufactured systematically, and will be extensively curated/resharpened.

4. Generalized tools and weapons of lower importance in food and shelter provisioning (choppers, cleavers, etc.) will be made primarily of local raw materials, be manufactured less systematically, and will be made and used as disposables.

PROCESS 2: CULTURAL EVOLUTION

The initiation of the Sykes-White Springs portion of the Middle Archaic (ca. 6,500-7,000 B.P.) appeared to signal a threshold crossing of adjustments to the floodplain that culminated later in the Benton culture (5,000-6,000 B.P.). New site features which appeared included prepared areas with multiple hearths which were probably residential areas, burials which were either associated with the large prepared areas or in ordered and separate cemetery areas. Many hearths were also discovered on the general site surface at this time.

Locations that were once short-term campsites in the early Archaic period were used as base camps, perhaps on a year-round basis, and they were more widely and regularly spaced. The population organization apparently shifted from small, dispersed groups, utilizing both uplands and lowlands to nucleated, large groups focusing on the floodplain. Apparently fewer locations were occupied by Benton groups than in earlier periods, but they were occupied by larger groups engaged in a wider variety of activities.

Several alternative hypotheses can be generated to explain the archaeological record during this period. Each has expectable results which would be present and testable in the archaeological record.

Hypothesis 2: The Kirk, Eva-Morrow Mountain, Sykes-White Springs, and Benton occupations represent an evolution of adjustments in subsistence and settlement strategies.

Test Expectations

1. Smooth evolution (continuity) should be present in tool technology, raw material use, and stylistic indicators of the Kirk, Eva-Morrow Mountain, Sykes-White Springs, and Benton assemblages. Abrupt changes should not be present.

2. A gradual increase in the amount of cultural material, tool manufacturing debris, broken and lost tools, charcoal, organic remains and features, and initiation of more permanent site facilities is to be anticipated.

Hypothesis 3: Eva-Morrow Mountain culture evolved from the Big Sandy and Kirk cultures of the Early Archaic, but the Sykes-White Springs/Benton is an expansion of ideas or people from elsewhere and is actually a part of another cultural tradition.

Test Expectations

1. Continuity of evolutionary changes should be present in assemblages of Kirk and Eva-Morrow Mountain in tool technology, raw material use, and stylistic indicators. Discontinuity should be present between them and the Sykes-White Springs and Benton cultures.

2. Tool inventories and uses of tools should differ in Kirk-Eva-Morrow Mountain and Sykes-White Springs/Benton.

3. Abrupt increases/changes in site use (length of occupation, facilities, and features) should be evident and correlate with the appearance of the Sykes-White Springs/Benton occupations.

4. There should be significant homogeneity within and between early Sykes-White Springs/Benton settlements in subsistence and technology, indicating their common culture and interaction characteristic of pioneering settlements.

5. The resident population's (Eva-Morrow Mountain) nonfunctional traits of material culture, such as style of implements or burial practices, will not be incorporated into the immigrants' material culture.

Hypothesis 4: The process by which Sykes-White Springs/Benton culture developed into the Upper Tombigbee Valley was by diffusion of ideas from outside the area.

Test Expectation

1. There will be noticeable continuity through the evolution from Eva-Morrow Mountain and Sykes-White Springs/Benton nonfunctional aspects of material culture such as styles of implements and burial practices.

Hypothesis 5: The large floodplain sites of Sykes-White Springs/Benton were occupied throughout the year with other localities being utilized for specialized extractive purposes.

Test Expectations

1. The seasonal indicators (flora and fauna) in the large floodplain sites will be from all seasons of the year.

2. There will be a difference in site facilities and range of activities between the floodplain sites.

PROCESS 3: TRANSITION TO THE TERMINAL LATE ARCHAIC

In the archaeological sites investigated in the Upper Tombigbee Valley, there appeared to be a cessation of the Benton "way-of-life." Noticeable changes in site use, tool manufacture, tool inventory, and raw materials were indicated. Preliminary analyses indicated there might have been a return to the "Eva-Morrow Mountain way-of-life" rather than an evolution out of Benton into Little Bear Creek. While the issue can be framed into testable hypotheses, there is a problem with the archaeological record, since many of the Little Bear Creek deposits were disturbed. Only one intact Little Bear Creek cultural deposit was available, and it was not on a former large Benton floodplain site. Therefore, the test expectations of the hypotheses below are tailored to the specific project data.

Hypothesis 6: The Sykes-White Springs/Benton culture was a temporary intrusion into the Upper Tombigbee Valley, and the local population was never integrated. After the Benton exit, the local population resumed use of their former sites.

Test Expectations

1. There should be measurable similarities between Kirk/Eva/Morrow Mountain and the Little Bear Creek assemblages in tool technology, raw materials, stylistic patterns, tool inventory, site use, and facilities.

2. There should be measurable differences between Benton and Little Bear Creek in these same aspects.

Hypothesis 7: The Sykes-White Springs/Benton culture evolved into the Little Bear Creek culture.

Test Expectation

1. There should be measurable similarities and continuities between the material remains and gradual change in site use and facilities.

OTHER ADDRESSABLE CULTURAL ISSUES

Culture history and lifeway level issues of the Gulf Formational and Woodland stages could also be tested in this project. These research questions were concerned with the Woodland ceramic style/horizon sequence and the design methods and technological variability among Alexander (middle Gulf Formational) ceramics.

One component of the Henson Springs phase was a single-component site with both midden and features. This culture was difficult to study because only a small number of undisturbed sites were found and excavated (DeJarnette, Walthall, and Wimberly 1975; Atkinson et al. 1980; Bense 1982, 1983b; Jenkins 1979, 1981, 1982). The large sample of Henson Springs ceramics recovered from excellent context at one site offered a good opportunity to define the ceramic assemblage in the UTV with those of the mid-South and Coastal Plain. The following research question can be addressed:

Research Question 1: What designs and technologies characterize the Alexander ceramic assemblage at 22It563, what is their range of variability, and what is the relationship of the Alexander ceramic assemblage to that of the contemporaneous Tchefuncte, Bayou la Batre, Wheeler, and St. Johns cultures?

Two components of the Woodland stage were encountered which had sufficient integrity to provide further information. Site 22It606 had well-preserved Miller/Baytown and terminal Miller Woodland features. The Woodland ceramic sequence for the Upper Tombigbee Valley was not well understood, and it could be addressed through ceramic analysis similar to that utilized by Jenkins (1981) and Steponaitis (1983) in the Central Tombigbee Valley.

It appeared from preliminary analysis that the grog-tempered ware was utilized contemporaneously with the shell-tempered ware. If these ware groups were used at the same time in prehistory, overlap between the various modes of form and decoration within them should be obvious. A modal analysis similar to that outlined for 22It563 was implemented to test the degree of attribute overlap between the shell- and grog-tempered wares.

The other Woodland component with cultural history potential was 22Mo531, a burial mound of the Miller I (Middle Woodland) culture. These ceramics were used in comparison with those from 22It563 and other sites to refine the ceramic sequence of the Woodland stage in the Upper Tombigbee Valley. The research question was as follows:

Research Question 2: What refinements of the Woodland ceramic sequence can be made based on the material recovered from Sites 22Mo531, 22It606, and 22It563.

ADDRESSABLE ENVIRONMENTAL PROCESSES

In this project paleobotanical and geomorphological data were recovered which can be used to test parts of the paleoclimatic model. Paleobotanical data, consisting of pollen and charred plant fragments, were recovered from 22It590 (Ilex Site) in an Early Archaic context (ca. 9,000-7,500 B.P.) and reflect a boreal-type forest. This finding challenges the traditional paleoclimatic model for the Southeast, which postulates the disappearance of boreal forests ca. 12,000-13,000 B.P. years ago. Although extensive efforts were made to obtain radiocarbon dates on the deposit which contained this suite of boreal pollen, none were successful. However, the temporal projectile point/knife markers are well dated (Kirk and Greenbriar). A date range of 9,000-7,500 B.P. is likely for the deposits which contained the pollen. It was proposed that pollen in sediments of other Early Archaic components (if preserved) were to be compared to the 22It590 information. This comparison could help resolve the issue of whether the boreal forest indicated in the Ilex site area during the Early Archaic was an isolated relic stand or a indicator of a generally cooler climate.

An additional line of evidence can be applied to this question of Early Holocene climate: charred plant fragments. While there were insufficient amounts of the charred plant material for dating purposes, a botanical identification could be used to determine the nature of the environment near and on the sites during the Early Holocene.

Preliminary analyses of the sediments of the Early Holocene in this project and by Muto and Gunn (1985) have indicated that the floodplain surface was relatively unstable, and the Tombigbee possibly was a braided or early meandering stream during this time. Sediment analysis of the Early Archaic deposits could also be used to identify the depositional processes reflective of the environmental conditions of the Upper Tombigbee Valley.

The hypotheses and test expectation that structured the investigations into the Early Holocene environment in the Upper Tombigbee Valley were as follows:

Hypothesis 8: The Early Holocene period (ca. 12,000-8,000 B.P.) was cooler and moister than present, and the Tombigbee was a braided or early meandering stream.

Test Expectations

1. The pollen preserved in the sediments of this age will be boreal or coniferous species.

2. The macrobotanical remains will consist of plants which reflect cooler than present conditions.

3. The sediments of the deposits will be coarse and in lenticular or massive deposits.

The second environmental process which could be addressed was the mid-Holocene climatic episode known as the Altithermal. This episode has been characterized as the episode of maximum Holocene warmth, climatic stability, and possible dryness. The episode has been documented in pollen studies from the Appalachians to Missouri, Arkansas, and Tennessee (Delcourt 1979; Delcourt and Delcourt 1979). Pollen data from the upper Central Tombigbee Valley near Columbus, Ms. also indicated maximum xeric conditions ca. 5,000 B.P. (Muto and Gunn 1985). Six sites which contained intact alluvial deposits of the appropriate age which could be examined to determine the nature of the Altithermal episode in the Upper Tombigbee Valley.

The unexpected discovery of well-developed paleosols with argillic horizons in the Upper Tombigbee Valley floodplain sites raises many questions which have direct bearing on understanding environmental settings. The paleosols developed in sediments of the Late Pleistocene and Early Holocene and contained Early and Middle Archaic cultural material. Distinctive morphology and perhaps chemical and mineralogical domains could be examined to gain better factual understanding of past landscape evolution.

Hypothesis 9: Mid-Holocene climate (ca. 7,500-5,000 B.P.) was characterized by an increase in warmth and dryness which reached maximum levels between 6,500 and 5,000 B.P. This was also a period of landscape stability. More mesic conditions began ca. 5,000 B.P. and extended to those of the present between 4,000 and 3,000 B.P.

Test Expectation

1. The pedological data will indicate that the mid-Holocene period was stable and reached a xeric maximum after the soil development.

The third environmental/geomorphic process which could be examined was the unique dark, humic-stained soil epipedons. These are specific to archaeological sites and are the most visible pedogenic feature. These culturally produced features are apparently reflective of specific conditions of the past occupations and are different than the soil-forming processes operating today. The carbon/nitrogen ratio, organic acid complexes, phosphorus components, and other features may be unique. The epipedons have persisted for 5,000-6,000 years of weathering in a very humid climate, but the rate and extent of change are unknown.

The environmental conditions and temporal factors necessary for the formation of the dark epipedons were an enigma and offered an excellent opportunity better to understand the past. An understanding of the mechanisms of their formation and temporal changes was critical. The epipedons may represent dynamic balances of the past and consequently may be undergoing a terminal change in our existing environment. Neither their basic nature nor the extent to which leaching, oxidation, erosion, weathering, lack of organic additions, perturbation, and volatization was influencing these epipedons was understood. Understanding these unique features produced by past cultures could expand the knowledge of the past and create a better awareness of the dynamic changes of the pedosphere of cultural sites.

Research Question 3: What is the physical, chemical, and mineralogical nature of organic-stained soil epipedons which are definitive of past habitation sites of the southeastern United States, and how is the development of these epipedons related to cultural and environmental activities?

HYPOTHESIS REFINEMENT

The lithic analyses constitutes the bulk of the Phase III cultural material and just prior to the initiation of the lithic analysis in Phase III the hypotheses which pertained to the Archaic were reevaluated. At this point the lithic specialist and replicator had been selected, and which operationalized the hypotheses in detailed final analysis was to be designed. The focus of the Archaic study was centered on the difference of the Sykes-White Springs/Benton components in the Upper Tombigbee Valley midden mounds. Of the six first-generation hypotheses concerning the Archaic, five dealt with this phenomenon based on three observed differences or changes.

1. Local Camden and Tuscaloosa chert cobbles were used in the non-Benton assemblages, and Fort Payne chert imported to the sites as bifacial preforms were found in Benton assemblages. Fort Payne chert was probably imported from the Middle Tennessee Valley 30-70 km (18.6-43.4 mi) to the north.

2. A difference in the technology was used to manufacture chipped stone tools from cobble reduction in non-Benton times for the retouching of the bifacial preforms of Fort Payne into finished tools in the Benton assemblage.

3. Site use from activities that produced low densities of cultural material, no organically stained midden, and few features in pre-Benton components changed to activities that resulted in extreme density of cultural material, dark-stained midden, and a plethora of features including prepared areas with multiple hearths, single hearths, refuse pits, etc. in Benton components.

A second generation of hypotheses were then generated that could address these observations through lithic analyses.

Hypothesis 1: The change in lithic raw material use occurred because of depletion of the local raw materials (gravel cobbles) which were buried in the floodplain of the Upper Tombigbee Valley.

Test Expectations

Non-Sykes-White Springs/Benton	Sykes-White Springs/Benton
more waste (quantity)	less waste (quantity)
high lithic quality	inferior quality
larger local cobbles	fewer large cobbles
initial cobble reduction	technological changes
less curation of tools	more curation of tools
reliance on local raw materials	more multipurpose tools
	more imported raw materials
	fewer tools lost or discarded

Hypothesis 2: The change in site use is due to a decrease in mobility of the resident populations during the mid-Holocene.

Test Expectations

Indices of mobility used in past research included hafting implements and tool complexity. Hafting of implements expands their task utility and more portability. Tool complexity is inversely related to population mobility. If Hypothesis 2 is correct, then the Test Expectations are:

1. Hafted tools will increase with decreased mobility.
2. Tools will be more complex with decreased mobility.

SUMMARY OF THE RESEARCH DESIGN

In the six and one-half years of this project, there have been two developmental stages or refinements of the research design. The initial research design, developed in 1979, was based on testing information and the general theory of cultural ecology. This guided the data recovery and preliminary analysis of Phases I and II. The second stage of the research design was formulated in 1983 with the development of the first-stage models of paleoenvironment and cultural adaptations based on the information recovered in Phases I and II as well as from other projects. From these models, hypotheses were generated, and others were refined, to allow testing with the data recovered in portions of this project. These hypotheses were further refined as they were operationalized, especially those utilizing lithic studies for hypotheses testing.

CHAPTER IV ARCHAEOLOGICAL PROCEDURES

FIELD PROCEDURES

Data recovery methods and techniques were designed to be compatible with previous investigations in the Tennessee-Tombigbee Waterway. Excavation strategies and field recovery forms were developed and standardized prior to Phase I to provide a minimum standard and comparable set of information for each site investigated. A Field Manual was developed during both phases of fieldwork. Only minor alterations, as noted in the sections below, were made for Phase II.

FIELD RECOVERY TECHNIQUES

SITE PREPARATION AND MAPPING

When necessary, site surfaces were cleared of vegetation by hand utilizing chainsaws, bushhooks, and axes. Once sufficient space had been cleared, a Cartesian grid was laid in at each site for horizontal control. An arbitrary 0-0 point was established off each site and a datum of 100S/100W was staked on-site. Sites which had previous grids established during testing of 22It539, 22It563, 22It576, and 22It590 were used during data recovery. All units were designated by the northeast corner coordinates. Baseline grid stakes were extended from the 100S/100W point to aid in topographic mapping and placement of cores and excavation units. Unless topographic or surface features interfered, site grids were aligned with magnetic north. Vertical control was established by setting in one or more benchmarks at each site. If an actual NGVD elevation could not be immediately established an arbitrary 100 m (330 ft) reference point was established for each site, and it was later tied into U.S. Army Corps of Engineers' benchmarks when possible.

A detailed topographic map was prepared for each site using either a transit or alidade and plane table. As excavation or test units were opened, these were added to the base map, or, if the site was complex, a separate excavation plan map was made.

DATA RECOVERY

SURFACE COLLECTIONS

Most sites investigated in this project had either been previously surface collected or there was no material on the surface. Two of the sites tested (22It622 and 22Mo675) were in plowed fields and had surface materials. The surface collection at these sites was by a random stratified sampling method, which selected units for 100%-timed collection of artifacts for a 20-22% sample of each site.

MECHANICAL EXCAVATIONS

At all of the sites during Phase I except 22Mo675 and 22It606, trenches were excavated by a backhoe to expose stratigraphic profiles prior to or shortly after excavations had begun. The trenches provided an assessment of site formation processes, means to delimit sites boundaries, and an aided in the placement of excavation units. At 22Mo675 and 22It590 a box-end scraper was used to strip mechanically the plow zone in selected areas to determine if features were present.

In Phase II, a backhoe was utilized at three sites (22It623, 22It634, and 22It621) to remove the overburden and expose the cultural deposits selected for investigation. Stratigraphic trenches were also excavated by a backhoe in Phase II.

VISUAL AND CHEMICAL CORING

Systematic cores were taken at two sites, 22It539 and 22It576, to aid in excavation unit placement and to locate subsurface anomalies. An Oakfield 3/4-inch Tube Sampler with extensions was used to remove 20 cm (7.9 in) samples from surface to the estimated base of the cultural deposits at specific intervals. Visual cores were examined in the field for cultural content and the presence of anomalies. Detailed notes concerning soil type, texture, color, and compaction, as well as cultural content, were kept for each core segment taken. Chemical cores were also taken at specified intervals, visual information was recorded, the soil was bagged, and sent to the field lab to be tested for pH, phosphate, and calcium carbonate levels. Field lab chemical testing was performed only on samples from the Poplar (22It576) and Walnut (22It539) sites. The results from the chemical test at these sites did not warrant continued use at other sites. The results of the visual cores and backhoe trenches proved to be the best methods of locating subsurface anomalies and determining unit placement.

EXCAVATION UNITS

Excavation unit location was usually determined by information gathered from research projects, surface collections, stratigraphic trenches, and coring along with any topographic site features. Additional units at the larger sites were located primarily on information obtained in the field as well as from stratigraphic information. At one site, 22Mo675, a combination of randomly selected test units was complemented by a judgementally placed unit.

The standard excavation and recording unit was 2 m x 2 m x 10 cm (6.6 ft x 6.6 ft x 3.9 in) in size and was removed by shovel. These units were placed individually or in groups (blocks) as desired. Smaller units were also excavated (1x2 m/3.3x6.6 ft, 1x1 m/3.3x3.3 ft, or 50x50 cm/19.7x19.7 in). The vertical dimension was occasionally divided into 5 cm (2 in) levels. At one site, 22It606, during excavation, no excavation units were used, rather the midden was removed, and only features were examined.

Excavation blocks were lettered sequentially on the site. One adjustment made in Phase II was that within each 2x2 m (6.6x6.6 ft) unit the four 1x1 m (3.3x3.3 ft) divisions were excavated separately, and 5 cm (2 in) levels were standard.

Features were sequentially numbered and handled as separate entities. They were mapped and photographed prior to, during, and after excavation. Features other than burials were generally bisected and removed by trowel with each half being separately processed by water flotation. Burials were mapped and photographed, and the bones were then carefully wrapped and moved to the field lab for special studies.

SPECIAL SAMPLES

Several types of special samples were recovered in the project. The most frequent types were materials found in situ during the general excavation, designated plotted specimens.

Radiocarbon samples were also taken from select *in situ* proveniences. These were removed with a clean trowel, placed in clean aluminum foil, then placed in a plastic bag.

One or more 50x50 cm (19.7x19.7 in) "control blocks" were located in each block of units. These were subdivided into four 25x25 cm (9.9x9.9 in) sections. At every 10 cm (3.9 in) level a four-liter macrobotanical sample and two-liter perpetuity/soil sample were taken. One quandrant was also fine-screened through 1/16-inch (.015 cm) mesh. Originally, there were three additional one liter soil samples taken from the fourth quadrant of each control block for pollen, biosilicate, and lipid analyses. Early in Phase I the decision was made that these samples could be obtained from the two-liter perpetuity/soil samples, if desired, so the quadrant was reincorporated into the general unit level fill. Two-liter perpetuity soil samples were also taken from the features and area and were placed in storage for future studies.

Archaeomagnetic dating samples were taken by archaeomagnetic consultant Dr. Robert DuBois at 22It539 and 22It576. Additional samples were later taken at 22It539 and 22It590 by Phase I staff personnel, who had been instructed by DuBois. All samples were dated at the Earth Science Observatory at the University of Oklahoma.

WATERSCREEN AND FLOTATION PROCESSING

All fill from general 10 cm (3.9 in) levels was processed through 0.63-cm (0.25 in) hardware mesh. Fine-screen samples from control blocks and features were passed through a 0.15 cm (0.06 in) mesh as well.

Most feature fill and other special samples were processed by flotation to recover macrobotanical materials. The flotation machine used followed the SMAP design after Watson (1976). One or two machines separated materials by water agitation into three fractions: 0.63 cm (0.25 in) "A" fraction, 0.15 cm (0.06 in) "B" fraction, and 0.5 cm (0.02 in or No. 35 sieve) "C" fraction.

FIELD RECORDING TECHNIQUES

MAPS AND SCALE DRAWINGS

The maps prepared for each site included a topographic map, a site excavation plan map, detailed drawings of stratigraphic profiles, and floor plan drawings of the base of each 10 cm (3.9 in) level in all units. The floor plan drawings were attached to the appropriate field form and traced in an on-site composite drawing of floor plans for each block. Pre- and post-excavation plan maps, as well as cross-section drawings, were completed for features.

PHOTOGRAPHS

Photographic logs were kept at each site for both black-and-white prints and color slides. General site photographs recorded all steps from pre-clearing, through excavation, to post-excavation views of each site. Features were photographed from pre- through post-excavation. Floor plans which exhibited unusual characteristics were photographed, as were all drawn stratigraphic profiles, and all block unit profiles. A permanent catalog and cross-index of all black-and-white prints and slides by subject and number was made for each site. Each slide was catalogued individually and placed in plastic sheets in notebooks ordered by site and slide number. The black-and-white contact prints were mounted on 5x7 inch cards with a copy of the photograph log information and ordered by subject. Black-and-white negatives were stored in glassine holders in notebooks by site and photograph number.

IDENTIFICATION NUMBER SYSTEM

An identification number (ID) system was used during both phases of data recovery in which each provenience and special sample was given a sequential site-specific identification number. Two minor modifications of this system were made in Phase II: the assignment of Master Identification Numbers System which grouped multiple numbers from the same general provenience (e.g. feature) was dropped and ID numbers were assigned in the laboratory rather than the field.

FIELD FORMS

The most frequent form was the Level/Stratum form which was completed for each 2 m x 2 m x 10 cm (6.6 ft x 6.6 ft x 3.9 in) level. This form recorded basic unit information (e.g., site; block; unit; elevation), associated ID numbers and types, soil information, and the excavator's observations and comments for each 2 m x 2 m x 10 cm (6.6 ft x 6.6 ft x 3.9 in) provenience. The feature form was similar to the Level Form and recorded similar information about features. If the feature was a burial, a burial number was assigned, and a Burial Record form was completed which detailed field observations on body orientation, position, preservation, age and sex determination, and component affiliation.

FIELD AND LABORATORY INTERFACE

All laboratory processing and classification for Phase I and most of Phase II was performed concurrently with excavation. The excavation of a minimum of two sites simultaneously plus large field crew, produced a large volume of material each day. A critical point in processing and organizing this volume of material was the daily transfer from the field to the lab, and a formal check-in procedure was developed to insure an accurate accounting of materials and accompanying paperwork.

LABORATORY PROCEDURES

METHODOLOGY

PROCESSING OF MATERIALS

Material from completed proveniences was tracked through the laboratory through a series of check-outs. Washing was usually done outdoors behind the laboratory but was also done in the laboratory during inclement weather. The washing process was basically a continuation of the waterscreening procedure. A garden hose with nozzle was used to spray water over each specimen until it was cleaned sufficiently for classification. The specimens were then dried outside or in a specially constructed heated dryer in the laboratory.

SORTING, CLASSIFICATION, AND CATALOGING

All cultural material was initially rough sorted into four material classes: ceramics, lithics (modified and debitage), introduced rock, and other (bone, shell, charcoal, and historic). Each of these rough-sorted classes was then processed separately.

CERAMICS: Ceramics were size-graded through 0.5 inch (1.7 cm) mesh. Those greater than 0.5 inch (1.7 cm) were sorted into types by temper and surface treatment. The ceramic types used in Phase I are defined in Appendix I of this report. Sherds exhibiting characteristics of vessel shape (rims, bases, podal supposts, and handles) were separated and designated diagnostic. Sherds in each type were counted, weighed, and cataloged. Ceramics passing through the 0.5 inch (1.7 cm) screen were classified as "sherdlets" and were collectively weighed, and a 20% sample by weight was cataloged. Daub and fired clay were included in the ceramic category, and they also were only weighed, and a 20% sample was cataloged.

LITHICS: The lithics in this investigation included modified lithics and debitage and were classified into groups by morphology, technology, and function. The Phase I and II classification definitions are presented in Appendix II of this report. All modified lithics were classified, counted, and cataloged. Lithic debitage included all flaked and fire-cracked chert or chunks and was size graded through 1.0, 0.5, and 0.25 inch (2.5, 1.7, and 0.8 cm) mesh screens. Each size grade was sorted by chert type and utilization. The count and weight of each category were recorded, and a 20% sample by weight was cataloged.

INTRODUCED ROCK: Introduced rock was used to refer to rock which did not naturally occur on the site but did not exhibit any observable modification. The specimens in these groups were identified lithologically, weighed, and 20% were cataloged.

OTHER: This group included items which were "other" than ceramics, lithics, or introduced rock, such as bone, shell, charcoal, or historic material. The low amount of historic material, plus the lack of a developed historic classification system in the earlier phases, necessitated a rough sorting of this material, and it was not computerized. Bone, shell, and charcoal was weighed and cataloged. The historic material was counted, weighed, and cataloged.

BOXING AND BAGGING

Most specimens were placed in sealed coin envelopes with provenience and classification information labeled on each. These were bagged by ID number and placed into plastic-lined cardboard boxes 1x1x1.5 ft (30x30x45 cm) in size. The boxes were organized by artifact group and ID number. The boxes were labeled on the outside and maintained in an organized manner in the field headquarters prior to transfer to the University of West Florida archaeological storage facilities.

The specimens selected for Phase III analysis were pulled from these collections and are curated separately from them. They are organized by provenience rather then ID number and cataloged by the most recent and highest level of analysis.

CHAPTER V SITE EXCAVATIONS

INTRODUCTION

This chapter describes the archaeological investigations conducted at the eleven sites included in this project and presents the results of the preliminary analysis of cultural material conducted in Phases I and II. Detailed studies of site soil, geomorphology, ceramics, lithics, and botanical information recovered from these sites will be presented in detail in subsequent chapters and will be briefly characterized in this chapter.

EXCAVATIONS AT THE POPLAR SITE (22It576)

The Poplar site was located in the active floodplain of the Upper Tombigbee Valley, 2.8 km (1.7 mi) northwest of Fulton in Itawamba County in northeast Mississippi (Figure 1) and was situated approximately 600 m (1,968 ft) west of the valley wall on a local topographic mound 40x50 m (132x165 ft) in area and 80-100 cm (31.2-39 in) above the level of the floodplain (Figure 3). The site was an isolated floodplain island bounded on all sides by second-order streams and abandoned channel segments of a complex floodplain swamp drainage system.

It appears to have originated as a point bar deposit in the floodplain which probably began as a truncated terrace outlier of the nearby valley wall. The site consisted entirely of fluvial deposits.

Prior to testing in 1979, the site was covered by mixed, second-growth hardwoods with a thick understory of shrubs and vines. The dominant trees were poplar (*Populas* sp.), oak (*Quercus* sp.), and hickory (*Carya* sp.).

FIELD METHODS

The Poplar site was initially recorded during Blakeman's survey (1975:19) of the canal section of the Tennessee-Tombigbee Waterway, and the surface collection indicated the presence of Gulf Formational and Woodland (Miller I and II) components. The site was recommended for testing to evaluate its information potential.

Testing conducted in January of 1979 (Bense 1982) consisted of three 2x2 m (6.6x6.6 ft) units which were excavated to 140 cm (55 in) below the surface. The excavation revealed a dark organic midden zone 90-100 cm (35.5-39.4 in) thick and a yellow-brown stratum directly below it. The cultural material recovered indicated that the site had been occupied from the Late Paleo-Indian through the Mississippian cultural stages. Intact components included examples of Paleo-Indian (Quad) and Early through Middle Archaic (Benton). The upper 70 cm (26.7 in) appeared to be mixed. A fired clay hearth associated with the Benton component, a pit containing Wheeler and Alexander sherds, five human teeth (possibly associated with the Wheeler component), and a dog burial were also recovered.

Subsequent excavations were conducted from February through September of 1980. Field methods used included: topographic mapping, visual and chemical coring, backhoe trenching, large and small excavation blocks, and expansion of the 1979 test pits. Soils and sediments were augered and samples, and monoliths were removed.

Seven hundred and twenty visual cores taken on a 2 m (6.6 ft) grid over the entire site surface provided the first data. Core depths varied from 60 cm (23.6 in) to over 220 cm (86.7 in), but always penetrated well below the

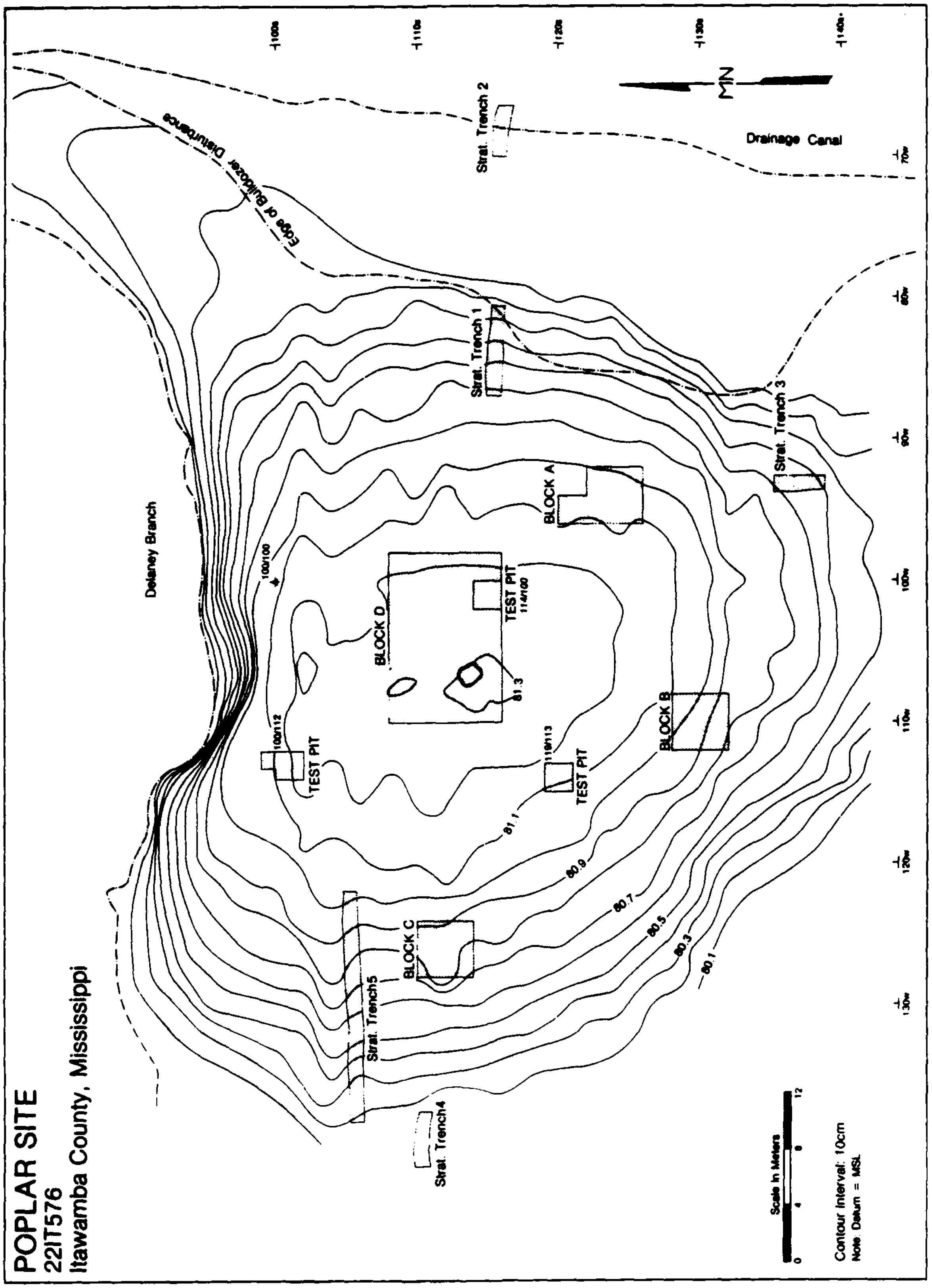


Figure 3 Topographic map and excavation plan, 22It576.

dark midden zone. The coring program was designed to identify subsurface anomalies and strata to ensure that excavation units would be placed in representative areas of the site. The visual core information was hand recorded and identified the location of charcoal, fired clay, artifacts, and strata. The visual cores indicated that the base of the dark organic midden was relatively level about 1 m (3.3 ft) below the surface and was underlain by a yellow-brown silty clay zone. Cultural material (charcoal, flakes, silty clay to sandy clay, fired clay, ash, etc.) dropped out at the interface of these strata.

Chemical cores were taken on a 8 m (26.4 ft) grid with two control transects samples at 4 m (13.2 ft) intervals across the major axis and deepest deposits of the site (112S and 108.5W). Samples in the chemical cores were taken every 20 cm (7.9 in) and were processed in the laboratory to determine pH, phosphate, and carbonate.

The pH and carbonate tests revealed no identifiable anomalies within the site. Phosphate content increased with depth and toward the center and northwest portion of the site. Site pH readings were lower, and the phosphate readings were higher on-site than off-site.

Four excavation blocks were completed at 22It576 (Figure 3). Blocks A, B, and C were 4x4 m (13.2x13.2 ft) in size and placed on the inner third or perimeter of the site area to investigate the site settlement pattern. Block D, the largest unit (12x8 m; 36x24 ft), was placed in the center of the site to test the area with thickest deposits and to embrace the test pit which produced the Quad projectile point/knife. All units were excavated by hand to sterile soil.

Block A was a 4x4 m (13.2x13.2 ft) unit, although a 20 cm (7.9 in) deep, 2x2 m (6.6x6.6 ft) extension was made subsequently to include a feature. This unit was placed in the southeast portion of the site to determine the nature of the mound periphery both geomorphologically and culturally. Previous investigations in this and other areas suggested that the edges of this type of site could contain structures and provide information on site morphogenesis. Proximity to the late Paleo-Indian material recovered in 1979 test unit 114S/100W was also suggested this test site choice.

Block B was a 4x4 m (13.2x13.2 ft)unit located in the southern part of the site. The unit was situated in an area of large grinding tools which were recovered during the excavation of the privy just to the south. Further, the site periphery questions addressed in Block A were also part of the goals of Block B excavation.

Block C was 4x4 m (13.2x13.2 ft) unit placed to investigate the area of high phosphate readings. The phosphate anomaly was actually 2 m (6.6 ft) south of the unit, but the presence of a large stump inhibited exact centering over the anomaly.

Block D was the largest unit excavated at the site. The placement was based on the following factors: 1) the high phosphate area in the site center, 2) the presence of deepest and most frequent cultural material and strata, and 3) the presence of late Paleo-Indian material in the 1979 test unit. Information from testing other similar sites in the area also had indicated that the most informative cultural deposits of the midden mound were in the areas of highest elevation (Atkinson 1974; Bense 1982; Galm 1978, 1981). This block was excavated through Level 23 in the northwest corner 2x2 m (6.6x6.6 ft) unit. The remaining western half of the unit was excavated through Level 22, and the eastern half was excavated through Level 17. Differences in excavation depths in this block occurred to confirm the culturally sterile deposits and to explore for possibly deeply buried cultural materials.

The three 1979 test pits excavated were extended to sterile soil in the 1980 excavations. Test Unit 100S/112W was extended 1x1 m (3.3x3.3 ft) in the north wall to include a feature for removal.

Five stratigraphic trenches were excavated with a backhoe to investigate further investigate the site sediments (Figure 3). Trench placement was based on information recovered in the excavation units. Trenches were placed primarily on the edges of the site - a sensitive area in determining site formation. Block excavations provided a sufficient view of the interior site deposits and no backhoe trenches were placed there. Trench 2 was placed off-site in the edge of the drainage canal to obtain maximum depth and to expose the deposits of gleyed clay which underlie the Holocene deposits in the Upper Tombigbee Valley floodplain.

CULTURAL REMAINS

Cultural material recovered from the Poplar site include ceramics, stone tools, debitage, ground tools, and animal and plant remains. The following sections describe material recovered by artifact class.

A total of 16,289 sherds were recovered at the Poplar site (Table 3). Although the temporally sensitive types were vertically mixed at this site, a few patterns were observed. While sand-tempered wares dominated all levels, in Blocks A, B, and C, Wheeler Plain or Eroded Fiber ranked second in frequency in all levels, with the exception of Level 1, Block C which contained a greater proportion of Mississippian Plain. In Block D, the Mississippian and Late Woodland types Mississippi Plain or Baytown Plain were second to sand-tempered types in the upper 20 cm (7.9 in) of the site. This could reflect differential site use during these periods.

TABLE 3

Ceramic frequencies by temper, 22It576.

Temper	Frequency	Percentage
Shell	1,305	8.0
Shell-Grog	363	2.3
Grog	1,920	11.8
Bone	207	1.3
Limestone	1,501	9.2
Sand	8,638	53.0
Fiber	2,355	14.5
Total	16,289	

The relative frequency of the pottery types indicates that the site was occupied throughout the 4,000 years of the Gulf Formational, Woodland, and Mississippian stages. The frequency of temper groups associated with each stage may reflect relatively similar site activities during these stages. The relatively high percentage (14.5%) of fiber-tempered sherds may indicate a higher site use during the brief 500-year period they were in use.

A total of 5,081 chipped stone tool specimens was recovered from the site (Table 4). Of these, 1,176 were projectile points/knives (over 23.1%), cores (0.8%), preforms (3.8%), bifaces (4.7%), scrapers (3.9%), and other uniface and biface tools (56.9%).

A total of 5,234 utilized flakes were also recovered from the Poplar site. Since the frequency of these ready-made, disposable tools is higher than the number of chipped stone tools there must have been a steady and frequent need for them.

TABLE 4

Chipped stone tool frequencies by type, 22It576.

Type	Frequency	Percentage
Projectile Point/Knives		
Benton	12	
Big Sandy	2	
Big Slough	1	
Bradley Spike	2	
Collins	1	
Cotaco Creek	2	
Cypress Creek	2	
Dalton	2	
Elora	3	
Eva	44	
Flint River Spike	1	
Gary	3	
Greenbriar	2	
Kirk Corner-Notched	40	
Late Woodland/Mississippian Triangular	304	
Ledbetter/Pickwick	13	
Limestone	2	
Little Bear Creek/Flint Creek	368	
McIntire	15	
Morrow Mountain	17	
Mud Creek	1	
Residual Stemmed	150	
Residual Triangular	4	
Savannah River	3	
Swan Lake	2	
Sykes-White Springs	30	
Tombigbee Stemmed	1	
Small Unfinished Triangular	11	
Vaughn	4	
Subtotal	1,176	23.1
Cores	40	0.8
Preforms	192	3.8
Bifaces	238	4.7
Scrapers	198	3.9
Drills, Perforators, etc.	348	6.8
Other Uniface and Biface Tools	2,889	56.9
Total	5,081	

A total of 105,637 non-utilized flakes were recovered from the site. Table 5 presents the frequencies by size and excavation block. There is a high correlation between frequency and flake size. The 0.64 cm (0.25 in) debitage dominated (89%) debitage, while 1.27 cm (0.5 in) and 1.54 cm (1 in) non-utilized flakes consisted of only 11,308 (10.7%) and 291 (0.3%) specimens, respectively.

With the relative proportion of chipped stone tools to debitage of 1:10 and the flake proportion of 1:39:323 of quarter:half:one inch flakes, chipped stone tool manufacture and retouching are documented throughout site occupation.

TABLE 5

Size-grade frequencies of debitage, 22It576.

Flake size	Frequency	Percentage
1.0 inch	291	0.28
0.5 inch	11,308	10.70
0.25 inch	94,038	89.02
Total	105,637	

A total of 1,735 ground stone tools were recovered and include both ground and polished stone artifacts. As Table 6 shows, most specimens were unidentifiable fragments (1,386 or 80%). The most frequent identifiable ground stone categories are flakes of ground stone tools (n=67), ground limonite (n=56), hammerstones (n=52), and pitted anvilstones (n=33).

TABLE 6

Ground stone tool frequencies by type, 22It576.

Type	Frequency	Percentage
Hammerstone	52	3.0
Pitted Anvilstone	33	1.9
Hammer/Anvilstone	2	0.1
Abrader	16	0.9
Muller	5	0.3
Mortar	8	0.5
Pestle	1	0.1
Celt	1	0.1
Gorget	2	0.2
Atlatl weight	7	0.4
Discoidal	1	0.1
Bead	21	1.2
Sandstone sherd	10	0.6
Worked sandstone concretion	4	0.2
Ground limonite	56	3.2
Ground hematite	30	1.8
Edge-ground cobble	1	0.1
Other (ground flake)	67	3.9
Muller/Pitted Anvilstone	8	0.5
Drill Core	8	0.5
Bead Preform	7	0.4
Muller/Hammerstone	2	0.2
Soapstone	1	0.1
Ground projectile point/knife	1	0.1
Tubular pipe	2	0.2
Mortar/Anvilstone	1	0.1
Pitted Anvilstone/Abrader	2	0.2
Unidentified ground stone fragments	1,386	79.9
Total	1,735	

The vast majority (88.4%) of the 741,727 grams of introduced rock from 22It576 consisted of sandstone, followed by fire-cracked chert chunks (4%), and cobbles (1.4%). Use of the dominant ferruginous sandstone cannot be fully explained; however, it is the most abundant locally available rock and the only type in the Upper Tombigbee Valley that occurs in large flat slabs.

The few (176) historic specimens recovered from this site include hunting and fishing implements (13), metal container fragments (64), fasteners (13), wire nails (77), and miscellaneous material (9). Most of the historic/modern material was recovered in the mixed upper 50 cm (19.7 in) of the site deposits and historic intrusions such as potholes. The range of materials reflects the historic activities which are known to have occurred at the site, i.e.: logging, cultivation, pig containment, relic collecting, hunting, and fishing.

Faunal fragments consisted primarily of calcined and charred fragments and only 609 (12%) of the 4,953 analyzed were identifiable beyond the class level of identification, primarily because of the small size of the fragments. Consequently, the faunal information is best viewed as qualitative rather than quantitative. The identifiable faunal material included both large and small mammals, birds, reptiles (especially turtles), and fish. Most of the faunal material from the midden came from Block D and in the upper 50-60 cm (19.7-23.6 in) which contained mixed Gulf Formational through Mississippian temporal markers.

FEATURES

The investigations encountered 93 features which were classified into ten feature types:

8 chipped stone clusters
9 rock clusters
29 fired aggregates
1 hearth
2 prepared areas
43 pits
1 ceramic cluster

The cultural affiliation of the features was determined by diagnostic artifacts and/or stratigraphic position of origin. If a feature did not contain any diagnostic or temporal markers and the stratigraphic position was unclear, the cultural affiliation was classified as unknown.

Only one ceramic cluster was encountered at this site. It consisted of a major portion of one plain grog and shell-tempered vessel. The vessel was lying upright just below the plow zone and the upper portion, including the rim, had been removed by the plow.

Of the eight chipped stone clusters, one was a cache of thinned bifaces ("quarry blades") made of Fort Payne chert. This cache of blades (Feature 10) contained four bifaces and one piece of sandstone. The bifaces were similar in size and shape, approximately 11 cm (4.3 in) long and 1-5 mm thick. While the context was mixed with markers from the Middle Woodland and the Middle Archaic (Benton), similar features from similar sites have been documented as associated with the Benton occupation and this is likely the case here.

The remaining chipped stone features were concentrations of chipping debris and broken tools. Two (Features 9 and 16) were located in the upper levels (5 and 1, respectively), and their cultural affiliation is unknown. The remaining five chipped stone clusters (Features 113, 116, 118, 119, and 120), were located in the western portion of Block D in the Early Archaic component. The largest and most dense clusters (116 and 118) were within a 2 m (6.6 ft) area at the same elevation and contained a variety of complete tools including a side scraper, a flake knife, and a core. Additional materials consisted of broken bifaces, utilized flakes, and over 200 non-utilized flakes. Both clusters were extremely concentrated and appeared to be piles. This was not the case for all the chipped stone cluster features, since 119 contained only 33 specimens, including only one unidentified tool and a utilized flake. Another (120) was a linear arrangement (60x20 cm or 24x7.8 in) of a small number of tools and flakes. An additional Early Archaic chipped stone cluster was present in the northwest corner of Block D at Level 15 but was not noticed in excavation, however the 5 cm (2 in) levels applied sufficient control to reconstruct the feature.

The Early Archaic features appear to be the results of tool production, maintenance, use, and breakage. Concentration of this activity in the center of the site is supported by the absence of these features in other parts of the site at this level. It is likely that this part of the site was highest (epicenter) during this occupation.

Nine rock clusters were identified at 22It576. These features were generally oval and ranged from 2.42 m (8 ft) to 0.17 cm (0.7 in) in diameter. They were concentrations of unmodified fist-sized pieces of sandstone. Other cultural material included in the rock clusters consisted of ceramics, chipped stone tools, ground stone tools, flakes, fire-cracked chert, and fired clay. The range of material appears to be related to size of the feature, i.e., the larger the feature, the more diverse the cultural material.

These features were likely related to fire hearths, rock ovens, and/or refuse deposition. Four were associated with other fire-related artifacts, such as fire-cracked chert. The remaining rock cluster features which contained a wide variety of tools were likely related to refuse deposition.

Twenty-nine fired aggregate features were encountered. Most were recovered in Block D (23), Block A (6), and with only one in Block B. The fired aggregates were composed of hard fired orange-colored silt loam and averaged 9 cm (3.8 m) thick, 48 cm (1.6 ft) long, and 36 cm (1.2 ft) wide. They were devoid of artifacts, charcoal, and ash. Associated cultural material was quite difficult to document because encircling stains or other mechanisms of association were leaving in the surrounding dark, culture-rich, organic midden. The silt loam was brought to the site from the adjacent wetlands, and the highly oxidized, burnt orange color of these features suggests that they were specially prepared hearths.

A basin-shaped hearth encountered in Block A was 36 cm (1.2 ft) wide, 62 cm (2.8 ft) long, 10 cm (3.9 in) deep and was composed of gray, burned clay. The dark brown midden fill in the basin contained eight fiber and sand-tempered sherds, two ground stone fragments, 13 flakes and sandstone. If this fill was in situ, it appeared to be associated with the Gulf Formational stage.

Two prepared areas were encountered at 22It576: Features 44 in Block D and 49 in Block A. Both were characterized by a mottled yellow, clay loam matrix with areas of concentrated clay. These features were actually a mosaic of fired areas, fired aggregates, and scattered fired clay fragments. Only Feature 44 was completely exposed and measured 4.4x3.2 m (14.4x10.5 ft) and was 5-10 cm (2-4 in) thick. The portion of Feature 49 which was exposed measured 5x4.6 m (16.4x15.1 ft) and was 23 cm (9 in) thick. The two prepared areas varied in consistency. Feature 44 was not compact, had diffuse edges, and contained significant quantities of charcoal. Feature 49 was compact throughout, had little charcoal, and had the appearance of being cleaned. Both prepared areas had fired aggregates, pits, postmolds, and burials associated with them. It is inferred that they were centers of intense cultural activity.

Forty-five pits were encountered. The cultural material in the pits was not different from that contained in the surrounding matrix. Pits were generally characterized by a dark color of the internal fill and concentration of cultural material. Thirty-two (71%) of the pits could be associated with the Sykes-White Springs/Benton component. Only one pit could be affiliated with the Eva-Morrow Mountain component, while eight pits extended into the Kirk zone. These eight pits contained no diagnostic material, and it is postulated that they are lower portions of pits intruding from later components. Two additional pits were identified in the upper 30 cm (10 in) of the dark midden, and cultural affiliation could not be determined.

Four historic intrusions were identified, all of them in Block D, including two open potholes on the surface. Two other filled potholes were identified during excavation. One large filled pothole was 1.4 m (4.6 ft) deep, with a burned fencepost standing upright with in it.

One stain feature was recorded at this site. It was circular and lens-shaped with yellow mottled soil containing material similar to the surrounding midden. These deposits were so numerous and undifferentiated from the surrounding midden in this and several other midden mound sites in the project that it soon became inefficient to separate those lenses of yellow-brown soil. Their function was not determined, and speculation suggests that they were probably accidentally brought on site from the adjacent wetlands.

Eleven burials and three cremations were recovered at the Poplar site. The majority were located in Block D, with one burial each in Block A and test pits 99S/112W and 119S/113W. Burials were usually discovered by exposure of skeletal parts, a dark stain above the skeleton, or a concentration of fired silt loam. Burial pits were not discernible in the dark midden and were poorly defined even in the yellow-brown zones below. The average depth of the portions of excavated burial pits was 25 cm (9.8 in). The deepest burial pit was 73 cm (2.4 ft). A summary of the skeletal information is presented in Table 7.

TABLE 7
Burial analysis, 22It576.

Burial	Position	Side	Facing Direction	Age/Sex	Associated Materials
3	Unknown	Unknown	Unknown	Adult	
5	Flexed	Left	North	Elderly female, 40+	
6	Flexed	Back	Unknown	Adult	
7	Flexed	Right	North		
8	Unknown	Unknown	Unknown	Adult, probable male	
10	Unknown	Unknown	Unknown	Adult	
11	Flexed	Right	South	Female 30	
12	Extended	Supine	Northwest/ southwest	Adult male	Cache of tools
16	Extended	Supine	North/south	Adult male	Dog skull

Of the eleven burials, four were flexed, two were extended, and the position of five was undetermined. The skeletal material was always in a soft, friable condition, frequently impossible to remove intact. Of the eight skeletons examined, three were males, two were female, and the sex of the three remaining was not ascertained. The burials probably occurred during the Middle Archaic occupations of the site (Eva/Morrow Mountain and Sykes-White Springs/Benton). Burial goods, including a dog skull and a cache of chipped stone bifaces, were present with two adult males.

STRATIGRAPHY

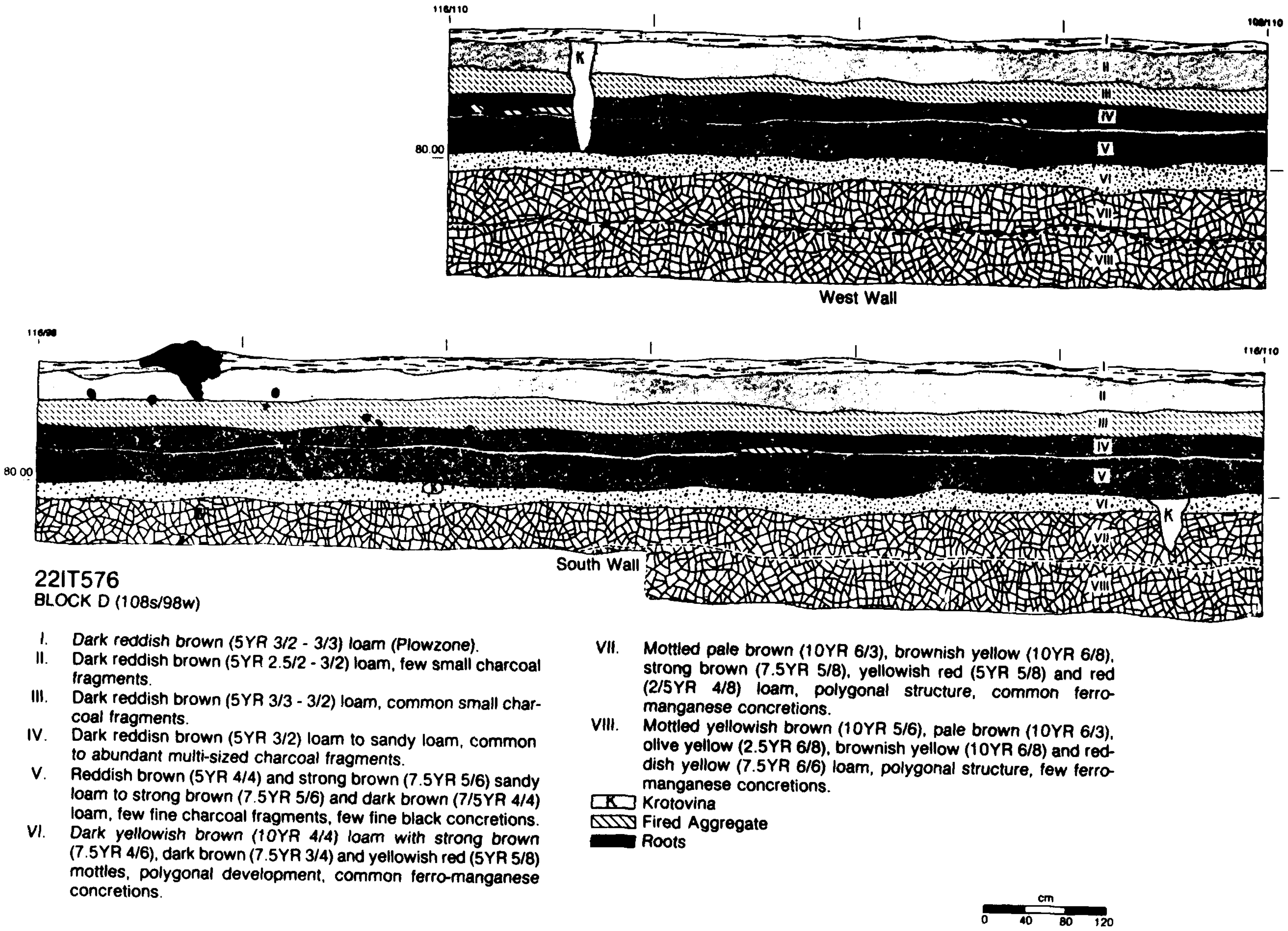
The Poplar site was composed of loamy fluvial sediments. The site appears to have formed as a point bar of a Holocene stream formed around and on compact basal eroded Pleistocene terrace outlier remnants. The course of the stream was then directed around the outlier forming the base causing deposition on the side of the bend, creating the point bar. There were eight relatively flat strata identified in this site (Figures 4 and 5) with tapered or lens-shaped edges. The strata were all present and thickest in the center of the site thinning erratically to the point of extinction near the out margins. The strata were organized into a dark brown organically stained midden zone (Strata I-V) and a yellow-brown paleosol with well-developed structure (Strata VI-VIII). The dominant texture of all deposits was loam which implies that the deposition was water flowing at a moderate velocity.

CHRONOMETRIC DATING

Seven radiocarbon and two archaeomagnetic samples were from 22It576 (Table 8). The radiocarbon samples were taken from control blocks of the midden deposits in Block D. Two of the samples were from culturally mixed deposits, two from the Sykes-White Springs/Benton, one from the Eva-Morrow Mountain, and one from the Early Archaic component.

TABLE 8
Radiocarbon and archaeomagnetic dates, 22It576.

Lab #/ Field Number	Block/ Level	C-14 (BP)	Uncorrected (Corrected) Calendar Age (BP)	Archaeo- magnetic Date	Material	Cultural Affiliation
DIC-2058/ 576-1170	D/2	4604±65	2654 (3210-3320)		nutshell/ charcoal	Mixed
DIC-1945/ 576-1456	D/4	5520±85	3570 (4270-4330)		nutshell/ charcoal	Mixed
DIC-1947/ 576-1759	D/6	5552±70	3602 (4330-4350)		nutshell/ charcoal	Middle Archaic/ Benton
DIC-1948/ 576-2578	D/8	5840±120	3890 (4530)		nutshell	Middle Archaic/ Benton/Sykes-White Springs
DIC-1949/ 576-3341	D/10	5995±155	4045 (4650)		nutshell	Middle Archaic/ Benton/Sykes-White Springs
DIC-2080/ 576-3517	D/11	4830±115	2880 (3410-3520)		nutshell	Middle Archaic/ Sykes-White Springs
DIC-2085/ 576-6792	D/14-16	7426±650	5476 (5900)		nutshell	unknown



22IT576
BLOCK D (108s/98w)

- I. *Dark reddish brown (5YR 3/2 - 3/3) loam (Plowzone).*
- II. Dark reddish brown (5YR 2.5/2 - 3/2) loam, few small charcoal fragments.
- III. Dark reddish brown (5YR 3/3 - 3/2) loam, common small charcoal fragments.
- IV. Dark reddisn brown (5YR 3/2) loam to sandy loam, common to abundant multi-sized charcoal fragments.
- V. Reddish brown (5YR 4/4) and strong brown (7.5YR 5/6) sandy loam to strong brown (7.5YR 5/6) and dark brown (7/5YR 4/4) loam, few fine charcoal fragments, few fine black concretions.
- VI. *Dark yellowish brown (10YR 4/4) loam with strong brown* (7.5YR 4/6), dark brown (7.5YR 3/4) and yellowish red (5YR 5/8) mottles, polygonal development, common ferro-manganese concretions.
- VII. Mottled pale brown (10YR 6/3), brownish yellow (10YR 6/8), strong brown (7.5YR 5/8), yellowish red (5YR 5/8) and red (2/5YR 4/8) loam, polygonal structure, common ferro-manganese concretions.
- VIII. Mottled yellowish brown (10YR 5/6), pale brown (10YR 6/3), olive yellow (2.5YR 6/8), brownish yellow (10YR 6/8) and reddish yellow (7.5YR 6/6) loam, polygonal structure, few ferro-manganese concretions.

K Krotovina
▨ Fired Aggregate
■ Roots

Figure 4 Stratigraphic profile of Block D, 22It576.

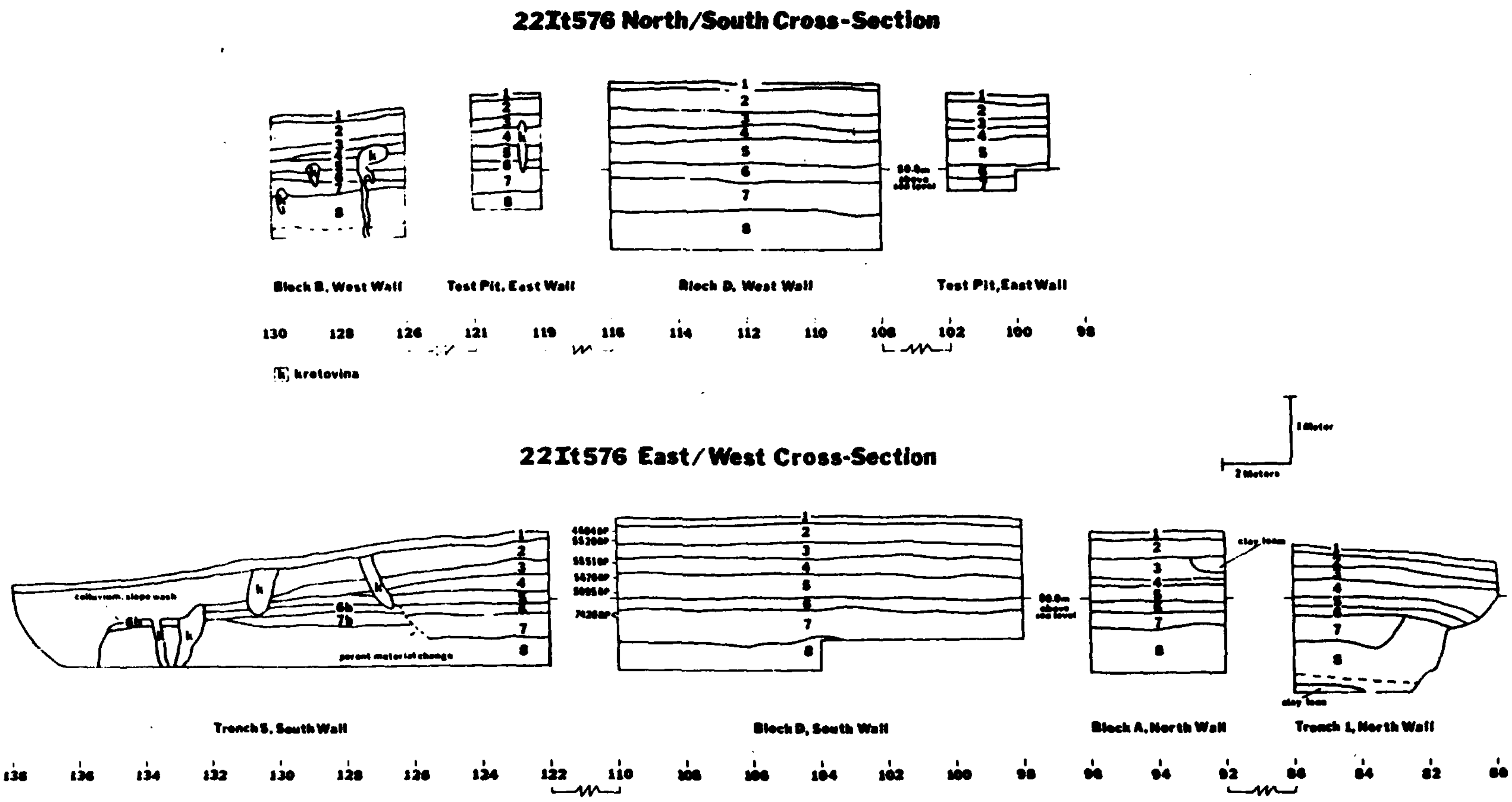


Figure 5 Stratigraphic cross-sections, 22It576.

TABLE 8

Radiocarbon and archaeomagnetic dates, 22It576 (continued).

Lab #/ Field Number	Block/ Level	C-14 (BP)	Uncorrected (Corrected) Calendar Age (BP)	Archaeo-magnetic Date	Material	Cultural Affiliation
Archaeo-magnetic	A/8			5850±50-75		Benton Feature 58
Archaeo-magnetic	D/7			4450±50		Benton Feature 50

a = Corrections calculated based on Masca curve (Ralph et al. 1973).

The Benton and Sykes-White Springs dates agree with those from similar components at other project (22It539 and 22It590) sites. The 5,995±155 B.P. date for Eva-Morrow Mountain is marginally young but within an acceptable range. The date of 7,426±650 B.P. has an unacceptably high sigma and is not within the established chronological range for Kirk and Big Sandy projectile point/knife types. However, it may date the end of the Kirk occupation or beginning of the Eva/Morrow Mountain occupation. Regardless of context, the dates do increase in age with depth below the surface, illustrating a chronological stratified sequence.

Two archaeomagnetic samples from two hearths were submitted from the Poplar site. The hearths were associated with each of the two large prepared areas identified at the site. Feature 58, was a hearth in the prepared area complex in Block A (Feature 49) on the eastern edge of the site. This complex feature was constructed of compact clay, was well defined, and contained a flexed burial below the clay surface, clay-lined post mold, and six hearths. The archaeomagnetic date of 5850±50-75 B.P. was obtained from it, and it agrees with the documented date range of the Benton diagnostic markers associated with the feature complex.

The second archaeomagnetic date obtained was 4,450 B.P. from Feature 50, one of nine hearths associated with the complex prepared area in the center of the site, Feature 44. This feature complex was less compact than Feature 49, and the edges were more diffuse. The feature was mottled with stains and charcoal, unlike the homogeneous clean surface of the other prepared area. The date of 4,450 B.P. does not agree with the associated Benton diagnostic markers which have been consistently dated at 5,000-6,000 B.P.

This feature was difficult to define, and the association of the hearth with it was not ironclad. Two of the radiocarbon dates from the control block in the midden 5 m (16.5 ft) away were taken 10 cm (3.9 in) above and 10 cm (3.9 in) below the level of the feature. The date from 10 cm (3.9 in) above the feature was 5,552±70 B.P. and the date from 10 cm (3.9 in) below the feature is 5,840±120 B.P. The interpolated date of this hearth was approximately 5,700 B.P. The incorrect archaeomagnetic date probably was related to the newness of the interpolated curve of the magnetic pole drift. Logical inference suggests an appropriate correction.

SUMMARY

The multi-component Poplar site was situated on a small natural elevation (50x50 m: 165x165 ft) in the floodplain of the Upper Tombigbee Valley. The site was occupied for approximately 10,000 years by all recognized prehistoric cultural groups. Four large excavation units in areas of the site were investigated during the eight-month fieldwork period.

The excavations produced the expected cultural components and confirmed that the Benton through Kirk Archaic deposits were intact. The expected Paleo-Indian component was not encountered, and the complete Quad point recovered in testing was associated with the Kirk component and apparently out-of-context.

The most significant results of the investigations at the Poplar site included: 1) the isolated Early Archaic Kirk assemblages, 2) the plethora of site facilities during the Sykes-White Springs/Benton occupation, and 3) the correlation of Early Holocene (5,000-10,000 B.P.) site use changes with the established climatic and soil dynamics.

Ten components were identified at the site which included the prehistoric period from the Early Archaic through the Mississippian stages. Only three of these had both intact midden and features; i.e. Kirk, Eva-Morrow Mountain, and Sykes-White Springs/Benton. Three components had intact features but lacked midden deposits: Wheeler, Alexander, and Miller III.

Archaic Stage: The Kirk was the first period of occupation of the Poplar site and was contained within the Early Holocene paleosol which contained three identified zones (Strata 6, 7, and 8). The Kirk occupation was identified only in Block D.

Features associated with the Kirk component include five chipped stone clusters and eight pits. The chipped stone clusters contained a variety of complete and broken tools including scrapers, knives, cores, bifaces, and utilized flakes, as well as considerable debitage. It is likely that an additional unrecognized chipped stone cluster feature was also present in the northwestern unit of Block D in the Early Archaic zone which contained over 800 flakes. The pits contained only flakes and introduced rock.

The Kirk cultural material was concentrated in two layers which were separated by 10-15 cm (3.9-5.9 in) of relatively sterile sediments. These are labeled the "lower assemblage" and the "upper assemblage." Both extended across the entire block. The "lower assemblage" contained six projectile point/knives: Kirk (3), Big Sandy (2), and Greenbriar (1). The "upper assemblage" contained only two Kirk projectile point/knives.

The Early Archaic assemblage consisted of both complete and broken tools including projectile point/knives, scrapers, bifaces, spokeshaves, drills, perforators, abraders, flake knives, adzes, splintered wedges (piece esquilles), ground stone tool fragments, and utilized flakes. Non-utilized debitage was abundant (4,581) as was introduced rock (3,290 g).

Features and midden material of the Early Archaic component suggest some preliminary statements about the nature of the human activities at the site. Hunting and gathering food and hide, processing, tool production, and woodworking were all likely occupations of people who occupied the site. The activities inferred from the cultural material of the Early Archaic Kirk component indicate that this locale was most likely used as a seasonal camp.

The initial Middle Archaic component was restricted to the upper portion of the paleosol unit which had been truncated by erosion. Subsequent occupation of the site probably caused some mixing of the exposed midden. This inference is drawn from the presence of a few Sykes-White Springs and Benton projectile point/knives in this component. Two fired aggregates, one pit, and one burial were associated with this component. Stratigraphic position suggests that two rock clusters, three fired aggregates, three pits, and one burial were associated with this component, but such an association cannot be firmly established.

The Eva/Morrow Mountain midden deposits contained a wide range of chipped and ground stone tools. Biotic remains, especially hickory nutshells, and wood charcoal were also associated with this component. It appears that during this occupation the site was also used as a seasonal base camp but the more features and materials were left behind. Activities conducted included hunting, gathering, food processing, tool production and maintenance, woodworking, cooking, and inhumation with grave goods.

The Sykes-White Springs/Benton occupation of the Poplar site was measurably different than any prior or subsequent component. The distributions of Sykes-White Springs and Benton projectile point/knives at the Poplar site are similar in initiation and frequency peak. This similarity causes these markers to be considered as a single cultural manifestation. This pattern was also seen at the Walnut site. The primary characteristics of this component included:

1. Activity centers or prepared areas which were of fired clay loam from 2.6-4 m (8.6-13.2 ft) in diameter. Fired aggregates, pits, postholes, burials and cremations were associated with these.
2. The 30 cm (11.8 in) midden deposit had extremely high concentrations of charred floral and faunal remains, especially burned hickory nutshells.
3. The midden also had dense artifacts and fired clay.

The majority of features at the site resulted from this occupation. The range and type of these features indicate that the site was used for a long-term, multipurpose base camp.

The midden resulting from this component was distinguishable from other portions of the dark organic zone by the darker color deriving from the high density of charred wood and hickory nutshells. The major feature complexes occurred vertically within 10 cm (3.9 in). The "midden zone" of this component was not well defined, and had many specimens from later occupations. The designation of the 30 cm (11.8 in) as the Sykes-White Springs/Benton "midden" was based only on the frequency peak of the Benton and Sykes-White Springs projectile point/knife types and the high number of affiliated features.

One of the patterns observed in the associated midden material was an increase in the amount of tools and debitage of Fort Payne chert. The small size of the debitage, lack of cores or preforms, presence of caches of quarry blades, and a high proportion of projectile point/knives indicate that this raw material was introduced to the site in the form of prepared bifaces and that it was conserved through rejuvenation and sharpening. The increase of Benton projectile point/knives and the concomitant decrease in other tool types suggests the multiple uses of Benton projectile point/knives. This increase in use of this foreign raw material for basic stone tools is consistent with other Sykes-White Springs/Benton components in the Upper Tombigbee Valley.

The Poplar site was occupied during the Gulf Formational stage, including both the Wheeler and Alexander horizons. Unfortunately, the deposits containing the cultural material had been previously disturbed. Temporally sensitive Wheeler and Alexander series ceramic types were present in significant numbers. Three features were possibly associated with the Gulf Formational occupations. These included a hearth and two rock clusters. All three features had associated diagnostic ceramics; however, the midden was culturally mixed and the ceramics could have been intruded into them accidentally.

The hearth contained many macrobotanical specimens, including pieces of Curcubita rind. If this feature was from the Gulf Formational, it represents the earliest documentation of horticulture in the Upper Tombigbee Valley. Both Wheeler and Alexander series sherds were associated with the hearth.

The Poplar site was occupied during the Woodland and Mississippian stages. However, the integrity of the deposits destroyed, and little can be said of the nature of the occupation. Thousands of sherds from the Woodland and Mississippian periods were recovered; however, only one ceramic cluster (a large portion of a shell-grog vessel) (Feature 122) was encountered.

EXCAVATIONS AT THE WALNUT SITE (22It539)

The Walnut site located in the Upper Tombigbee River floodplain 16.5 km (26.4 mi) north of Fulton, Ms (Figure 1) contained deposits from the Early Archaic to present. This site was situated in the eastern part of the floodplain about 750 m (2,475 ft) west of the valley wall. It was a prominent topographic feature elevated above the surrounding lowlying floodplain subject to flooding during winter and spring months. The site was surrounded by wetlands including swamps and small sloughs. The coarse texture of the sandy loam soils in the mound indicated higher energy depositional events than those which characterized the surrounding silty sediments.

The Walnut site was roughly oval (Figure 6) 100x70 m (328x229.7 ft) and elevated 1.8 m (5.9 ft) above the surrounding floodplain. The central portion of the site surface was relatively flat. The steepest slope was on the northwest. The landform likely formed as a floodplain bar, probably initiated by an outlier of the nearby valley wall. Prior to testing, the Walnut site was covered with a hardwood forest including hickory, oak, and walnut.

Clearing, construction, and maintenance operations for the TVA transmission line had disturbed the central portion of the site (Figure 6). Earlier disturbances occurred because of logging, agriculture, and looting. Potholes of varying sizes and ages were scattered throughout the southern, wooded part of the site. The most disturbed areas were the southwest quadrant and around the transmission tower.

FIELD METHODS

The Walnut site was recorded in the first waterway-related survey of this area in 1972 (Lewis and Caldwell 1972:44), and was known to the local collectors for many years. Lewis and Caldwell (1972), as well as Blakeman (1975), noted the temporally diverse materials on the site surface and recommended that the site be tested. Testing was performed on the site by Bense (1982). The test investigations included a controlled surface collection, i.e. two 2x2 m (6.6x6.6 ft) hand-excavation units and four backhoe trenches. This information (Bense 1982:386) indicated that there were intact, stratified Middle and possibly Late Archaic deposits at the site.

Excavation was conducted between March and September of 1980. Chemical and visual cores, test pits, backhoe trenches, and large excavation blocks were all employed during site excavation. Systematic coring was the first activity performed at the site to aid in determining excavation unit placement. A total of 1,468 cores were examined on the Walnut site including visual cores at 2 m (6.6 ft) intervals, chemical cores at 8 m (26.4 ft) intervals, and two additional chemical core transects at 4 m (13.2 ft) intervals.

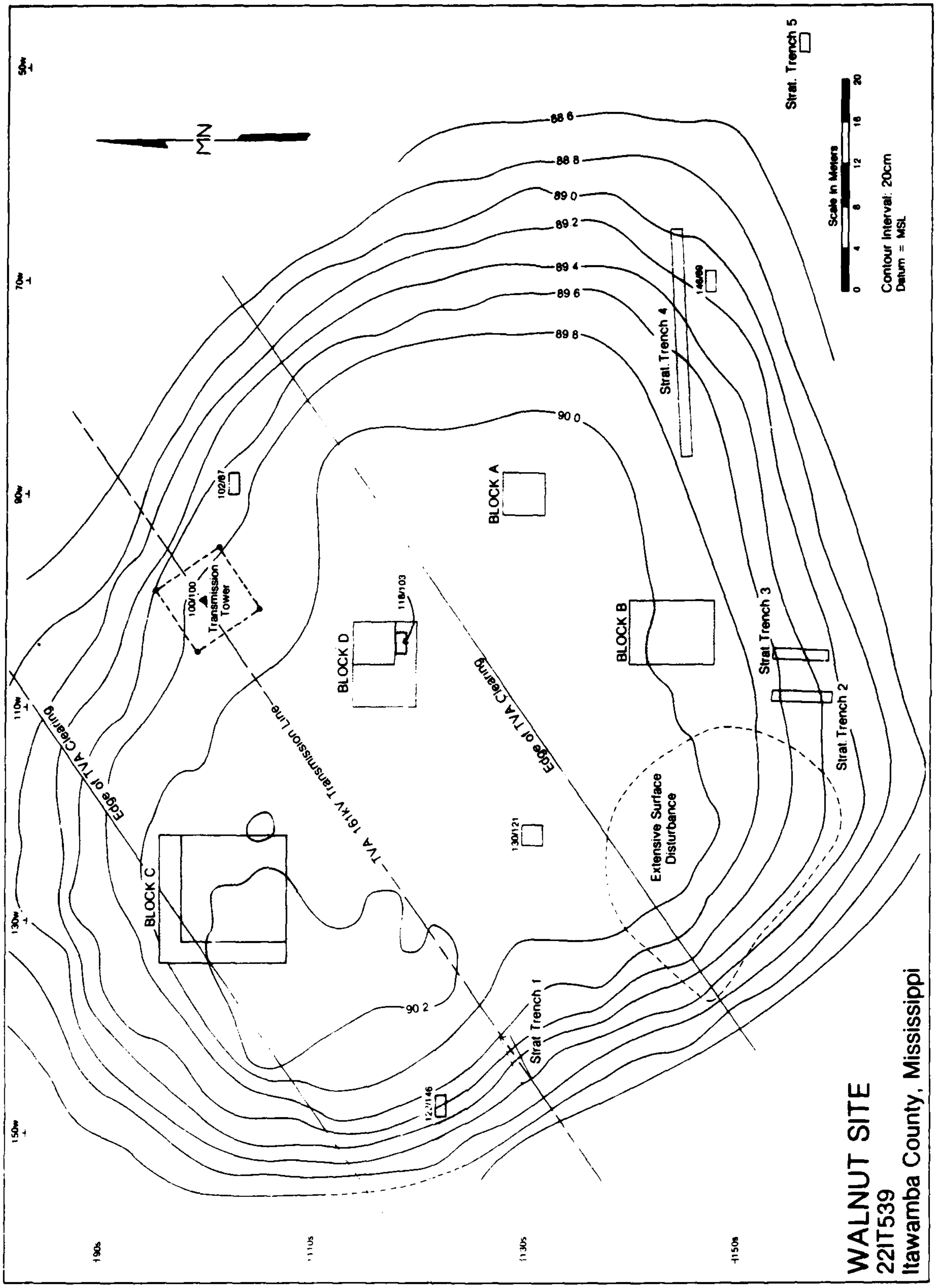


Figure 6 Topographic map and excavation plan, 22It539.

Visual cores recorded charcoal concentrations fired clay anomalies, and stratigraphic boundaries. Using these data two large excavation units were positioned directly over large fired clay areas. Excavations, however, exposed two additional large (greater than 2 m or 6.6 ft diameter) fired areas that were not identified in visual coring. Subsequent developments demonstrated that visual coring was not as informative for tracking subsurface anomalies as it had been at the Poplar site.

Chemical cores identified anomalies of pH, phosphates, and carbonates. Smaller excavation blocks were centered over two chemical anomalies to ascertain their origins.

Four large excavation blocks, A through D, were excavated on the Walnut site (Figure 6). Block A was a 4x4 m (13.2x13.2 ft) block placed on the wooded southeastern slope of the site in an area of low pH and high levels of phosphate suggesting of a potential trash disposal area. No visual core anomalies had been identified in the immediate area.

Block B was placed over a distinct fired clay deposit approximately 60 cm (23.6 in) below the surface observed in visual coring. No chemical anomalies were recorded. The block also served to sample the south-central area of the site. The block was initiated as a 4x4 m (13.2x13.2 ft) unit but was later expanded to an 8x6 m (26.4x19.8 ft) block in an attempt to identify activity areas associated with the fired clay feature.

Block C was placed over the largest and most well-defined fired clay anomaly, which had been located in visual coring. The fired material observed in the cores was 5-20 cm (2-8 in) thick with abundant charcoal in the surrounding area. Numerous additional visual anomalies were observed within 15-20 cm (6-8 in) of the fired clay area, suggesting that this was possibly an area of intense activity. Block C also served to sample the deposits in the northern and highest area of the site. This began as a 12x12 m (39.6x39.6 ft) block but was reduced to 10x10 m (33x33 ft) after the fired clay area was better defined.

Block D was located in the center of the site over a charcoal concentration identified in the visual coring. Initially, a 2x2 m (6.6x6.6 ft) test pit was placed over the anomaly (118S/103W). The results prompted excavation of an adjacent 4x4 m (13.2x13.2 ft) block, which was later expanded to 6x8 m (19.8x26.4 ft), when it became evident that the complex feature excavations in Block C would prevent that block from being excavated to the bottom of the site within the allotted time. Materials in the upper meter were removed with a backhoe to the deposits below the feature zone (Benton) which were then hand-excavated to sterile soil.

To obtain representative samples of all components of the site and to avoid over-representation of certain components at the expense of others, all blocks were not excavated systematically from the surface to the base of the site. In addition to the mechanical removal of the upper meter of material in Block D, the sediments below Level 13 of Block C (the Sykes-White Springs/Benton zone) were removed with a backhoe to determine if there were pits and burials which extended into the lighter colored sediments below the site.

During the first three months of excavations, it became progressively apparent that the large site size made it impossible to assume that the three major blocks under excavation (Blocks A, B, and C) were fully representative. Four additional 2x2 m (6.6x6.6 ft) test units were developed to be sure that the physical and cultural stratigraphy were better understood. These were located on the northeastern slope of the site (102S/87W), on the extreme southeastern edge of the site (146S/69W), on the western slope of the site

(122S/146W), and in the central area of the site (118S/103W). This central test pit led to the placement of Block D. To gather more data on the lower levels of the site at Block D, an original 2x2 m (6.6x6.6 ft) test unit (130S/121W) begun during testing (Bense 1982) was excavated to the base of the cultural materials.

Five trenches were excavated with a backhoe to investigate further the stratigraphy of the site. Selection of the trench locations was based on known stratigraphy in the excavation units and topographic position. Trench 5 was placed off the southeastern part of the site to investigate off-site sediments. It was dug to the level of the thick deposit of blue clay underlying the Holocene deposits in the floodplain.

CULTURAL REMAINS

A total of 5,220 sherds were recovered from the site. Seven temper types were identified: shell, shell-grog, grog, bone, limestone, sand, and fiber (Table 9). The ceramic temporal markers were confined to the upper 40-50 cm (1.3-1.6 ft) of the site, and were generally mixed vertically except in Block A. However, there was some horizontal patterning of the ceramics. The majority of Mississippian and Late Woodland ceramics were found in Block C. This was particularly true for shell-tempered ceramics. Grog-tempered ceramics were found more frequently in the southern portion of the site (Blocks A and B). The Middle Woodland limestone temper type was also differentially distributed with most being present in Block C in the northern part of the site. Gulf Formational ceramics, including fiber tempering, were relatively uniform in the excavation blocks. In the total ceramic sample recovered from the Walnut site, sand tempering was the most frequent (43.5%), followed by grog, shell, and bone (37.8%), and fiber (13.5%).

TABLE 9
Ceramic frequencies by temper, 22It539.

Temper	Frequency	Percentage
Shell	461	8.8
Shell-Grog	137	2.6
Grog	1,305	25.0
Bone	75	1.4
Limestone	367	5.1
Sand	2,269	43.5
Fiber	706	13.5
Total	5,220	

A total of 6,190 chipped stone tools were recovered (Table 10), principally consisting of unidentifiable fragments of unifacial and bifacial tools (4,405;71.1%). Projectile point/knives were the next in frequency (626; 10.1%). Collectively, these categories of chipped stone tools comprised 81.2% of the total stone tools from the site. The remaining 8.8% consists of small drilling tools (4.7%), scrapers (3.6%), bifaces (3.4%), preforms (3.1%), and cores (1.6%).

TABLE 10

Chipped stone tool frequencies by type, 22It539.

Type	Category	Frequency	Percentage
Projectile Point/Knifes			
	Benton	229	36.6
	Big Sandy	8	1.3
	Bradley Spike	2	0.3
	Crawford Creek	8	1.3
	Cypress Creek	11	1.8
	Dalton	2	0.3
	Laura	2	0.3
	Eva	4	0.6
	Flint Creek	9	1.4
	Gary	3	0.5
	Kirk Corner-Notched	14	2.2
	Late Woodland-Mississippian Triangular	70	11.2
	Ledbetter-Pickwick	7	1.1
	Little Bear Creek	3	0.5
	McCorkle Stemmed	1	0.2
	McIntire	1	0.2
	Morrow Mountain	27	4.3
	Mud Creek	3	0.3
	Residual Side-notched	1	0.2
	Residual Stemmed	79	12.6
	Residual Triangular	10	1.6
	Savannah River	1	0.2
	Sykes-White Springs	84	13.4
	Unfinished Small Triangular	13	2.1
	Vaughn	4	0.6
	Subtotal	626	10.1
Cores		99	1.6
Preforms		190	3.1
Bifaces		209	3.4
Scrapers		222	3.6
Drills, Perforators, etc.		292	4.7
Other Uniface and Biface Tools		4,552	73.5
Total		9,981	

Utilized flakes, numbering 3,791, were also abundant at this site. This reflects a high use of this tool of expediency. A total of 98,282 non-utilized flakes were recovered from the Walnut site. Table 11 demonstrates a correlation between flake size and frequency. Quarter-inch flakes account for 84.5% of the total half-inch flakes made up 15%; whereas inch or greater flakes amounted to only 0.4% of the total.

TABLE 11

Size-grade frequencies of debitage, 22It539.

Flake size	Frequency	Percentage
1.0 inch	360	0.4
0.5 inch	14,882	15.0
0.25 inch	83,040	84.5
Total	98,282	

The ratio of 1:16 tools to debitage reflects tool production and maintenance at the site. The proportion of flake sizes of 1:41:230 also supported the tool-to-debitage ratio.

A total of 2,044 ground stone tools were recovered from the site. Of these, 86% (1,757) were fragments of unidentifiable ground stone tools (Table 12). Hammerstones (2.5%), abraders (1.3%), and pitted anvilstones (1.2%) were the most frequent identifiable ground stone tools.

TABLE 12
Ground stone tool frequencies by type, 22It539.

Type	Frequency	Percentage
Hammerstone	52	2.5
Anvilstone	4	0.2
Pitted Anvilstone	25	1.2
Hammer/Anvilstone	5	0.2
Abrader	27	1.3
Muller	17	0.8
Mortar	16	0.8
Pestle	1	0.05
Grooved Axe	2	0.1
Celt	2	0.1
Gorget	1	0.05
Bead	15	0.7
Atlatl Weight	7	0.3
Ground Limonite	12	0.6
Ground Hematite	35	1.7
Ground Flakes - Other	42	2.1
Muller/Pitted Anvilstone	5	0.2
Drill Core	5	0.2
Bead Preform	3	0.2
Anvilstone/Chopper	1	0.05
Ground Projectile Point/Knife	1	0.05
Tubular Pipe	1	0.05
Mortar/Anvilstone	2	0.1
Mortar/Pitted Anvilstone	1	0.05
Pitted Anvilstone/Abrader	2	0.1
Grooved Abrader/Hammerstone/ Pitted Anvilstone	1	0.05
Awl	2	0.1
Unidentifiable fragments	1,757	86.0
Total	2,044	

A total of 500,295 grams of introduced rock and an additional 115,160 grams of fired clay and daub were recovered. The majority of introduced rock was ferruginous sandstone fragments. It is difficult to determine whether this material had been heated, but the purplish hue of most fragments suggests heating. Another major category of introduced rock was fire-cracked chert. Sandstone and fire-cracked chert comprised almost 93% of the introduced rock by weight. Other introduced rock categories included: coal, chalk, cobbles, pebbles, conglomerate, hematite, limonite, petrified wood, quartzite, and siltstone.

Two hundred historic specimens were recovered from the site. The majority (133) came from the upper three levels of Block C, and artifacts consisted primarily of unidentifiable metal fragments, with minor amounts of ceramic and glass materials. All of these materials proved to be recent or modern.

Four thousand two hundred and forty-five faunal fragments were recovered from this site. The identifiable faunal remains included mammal, bird, reptile, and fish skeletal material (Table 13). The remains were primarily calcined and broken bone fragments. The level of identification was low because of the small size of the fragments. All 6 mm (0.25 in) and large material was analyzed, but only a sample of the 2 mm (1/16 in) and smaller material was sorted and analyzed. The assemblage is best viewed as a qualitative data set, because species identification was very difficult. Some quantitative changes were evident in the amount of bone density between levels, but it is not clear whether this is a result of preservation or procurement strategies.

TABLE 13

Frequencies of faunal remains, 22It539.

Species	1/4 inch	1/8 inch
Mammal		
Opossum (*Didelphis marsupialis*)	4	
Eastern cottontail (*Sylvilagus floridanus*)	1	
cf. Woodchuck (*Marmota monax*)	2	
Squirrel (*Sciurus* sp.)		1
Mouse sp.		2
Canid (Canidae)		
cf. Raccoon (*Procyon lotor*)	1	
cf. Elk (*Cervus canadensis*)		
White-tailed deer (*Odocoileus virginianus*)	16	
Elk/Bison (*Cervus/Bison*)	1	
Pig (*Sus scrofa*)	2	
Antler (Cervidae)	11	
Indeterminate mammal bone	1,593	2,215
Subtotal, Mammals	1,631	2,218
Birds		
Turkey (*Meleagris gallopavro*)	4	
Passerine sp.		1
Indeterminate bird bone	26	67
Subtotal, Birds	30	68
Reptiles		
Snapping Turtle (*Chelydra serpentina*)	2	
Mud/Musk turtle (Kinosternidae)	5	
Eastern Box Turtle (*Terrapene carolina*)	50	
Slider/Map/Painted Turtle (*Graptemys/Chrysemys*)	9	
Softshell Turtle (*Trionyx* spp.)	10	
Non-poisonous Snakes (Colubridae)	10	3
Poisonous snakes (Viperidae)	1	
Turtle sp.	134	26
Subtotal, Reptiles	221	30
Fish		
Bowfin (*Amia calva*)	3	
Catfish (Ictaluridae)		2
Indeterminate fish bone	2	40
Subtotal, Fish	5	42
Total	1,887	2,358

FEATURES

Ninety-four features were encountered at the site including:

- 2 ceramic clusters
- 1 chipped stone cluster
- 4 botanical clusters
- 2 complex clusters
- 13 fired aggregates
- 2 hearths
- 61 pits
- 8 prepared areas
- 1 stain

Cultural affiliations of features at the site were determined either by directly associated artifacts or stratigraphic position. General feature categories are discussed in the following section.

Two features were complex clusters which were categorized by two different tool types. One was a concentration of ground and chipped stone in Block A. The other was a concentration of a grooved axe and mortar together with fragments of a projectile point/knife fragment and an unidentified chipped stone tool.

Thirteen fired aggregates and two hearths were encountered. These consisted of dense to diffuse, well-defined areas of fired silt loam fragments. The aggregates averaged 12 cm (4.7 in) in thickness and had an average diameter of 0.50 m (1.6 ft). They were most often devoid of charcoal and ash. The highly oxidized, bright burnt orange color and firm, massive consistency of these features suggests intense firing. All but one of these features were associated with the Middle Archaic Sykes-White Springs/Benton component at the Walnut site. Eight of these features were located in Block C, four in Block A, and three in Block D.

Eight prepared areas were encountered at this site. These were mosaics of fired areas and strata of various colors, predominately reddish and yellowish brown. Fired aggregates were often found in the center of these features and charcoal rich strata were often present. The outline of the prepared areas was asymmetrical to oval. The profile was lens-shaped. The internal strata were often gradational and sinuous, but fired aggregates were discrete and abrupt. The longest dimension ranged from 1.03 m (3.4 ft) to 6.39 m (21 ft) and averaged 2.8 m (9.2 ft). The average thickness was 24 cm (8.4 in) with the thickest area in the middle. Repeated episodes of burning appear to have taken place in these areas.

The largest prepared area 6.4x5.1 m (21x16.7 ft) was located in Block C (Figure 7) along with one smaller feature. Both were associated with the Sykes-White Springs/Benton component. Blocks A and B also contained one prepared area each associated with the same component. Four prepared areas were identified in Block D, and all were associated with the earlier Eva/Morrow Mountain component. These were somewhat smaller than the Sykes-White Springs/Benton prepared areas.

Sixty-one pits were identified at the Walnut site. While the cultural affiliation of 28 could not be ascertained, 28 were associated with the Archaic occupation of the site, 22 of which were Middle Archaic. Only one pit could be associated with the Gulf Formational component, three were affiliated with the Late Woodland, and one was a Mississippian pit. Pits were the most frequent single feature type encountered at the site (65%), and all appeared to be for refuse disposal.

Other features encountered included two ceramic clusters of Late Woodland and Mississippian types in Block B. One Block C concentration of chipped stone in the Sykes-White Spring/Benton zone. Only one yellow stain was removed as a feature, since it became clear early on that these amorphous phenomena could not be properly isolated.

Seventeen burials and one cremation were discovered at the Walnut site. Six burials were located in Block A, seven were in Block D, two burials and one cremation were in Block C, and two burials were in Stratigraphic Trench 2. Most of the burial pits were identified at the base of the dark midden and extended well into the yellow polygonal soil (Zone VII). The burial pits were over 2 m (6.6 ft) from the surface at their deepest point. Most burial pits appeared to originate in Zone VI, the Middle Archaic occupation zone. Burial and skeletal attributes such as age, sex, position, orientation, type, and artifact associations are described in Table 14 where possible.

TABLE 14
Burial analysis, 22It539.

Burial Number	Location	Age	Sex	Position	Type	Grave Goods
1	Block A	Indet.	Indet.	Extended	Primary, Multiple	Absent
2	Block A	Adult	Indet.	Extended	Primary, Multiple	Absent
3	Block A	Unknown	Unknown	Unknown	Unknown	Unknown
4	Block A	30 yrs?	Female	Extended	Primary, Single	Absent
5	Block A	40 yrs?	Male	Extended	Primary, Multiple	Present
7	Block C	Adult	Male	Flexed	Primary, Single	Absent
8	Block A	Young	Indet.	Indet.	Indeterminate	Absent
9	Block D	Indet.	Indet.	Flexed	Primary, Single	Present
10	Block D	Adult	Indet.	Extended	Primary, Multiple	Absent
11	Block D	Indet.	Indet.	Indet.	Primary, Single	Present
12	Block D	Indet.	Indet.	Indet.	Primary, Single	Absent
13	Block D	Indet.	Indet.	Extended	Primary, Single	Absent
14	Block D	Adult	Indet.	Extended	Primary, Multiple	Absent
15	Trench 2	Indet.	Indet.	Extended	Primary, Single	Absent
16	Trench 2	Indet.	Indet.	Extended	Primary, Single	Absent
17	Block D	Indet.	Indet.	Indet.	Indeterminate	Absent
18	Block C	Unknown	Unknown	Unknown	Unknown	Unknown
19	134	Adult	Indet.	Unknown	Cremation	Present

Although burials were found in most areas investigated in the site, two areas of organized burials were recognized, one each in Blocks A and D. The Block A burials contained six individuals, while Block D probably contained eight individuals. All burials were in the extended position except the cremation (Burial 19). The bodies had been placed in elongated, narrow pits which were organized into rows, and the rows were oriented north-south (Figure 8). The burial pits had both single and multiple interments. In Block A multiple burials were more common, and in one instance two individuals had been laid directly on top of one another (Burials 1 and 2). Figure 9 shows Burial 1, which was above Burial 2 in the same pit. The extent of the cemetery area in the vicinity of Block A was not determined, and two burials extended into the profiles of that unit indicating that burials extended beyond the areas investigated. Block D burials were well defined, suggesting a pattern of burials in rows (Figure 8). Block C and Stratigraphic Trench 2 burials may have been in organized units, but that is uncertain because of excavation constraints.

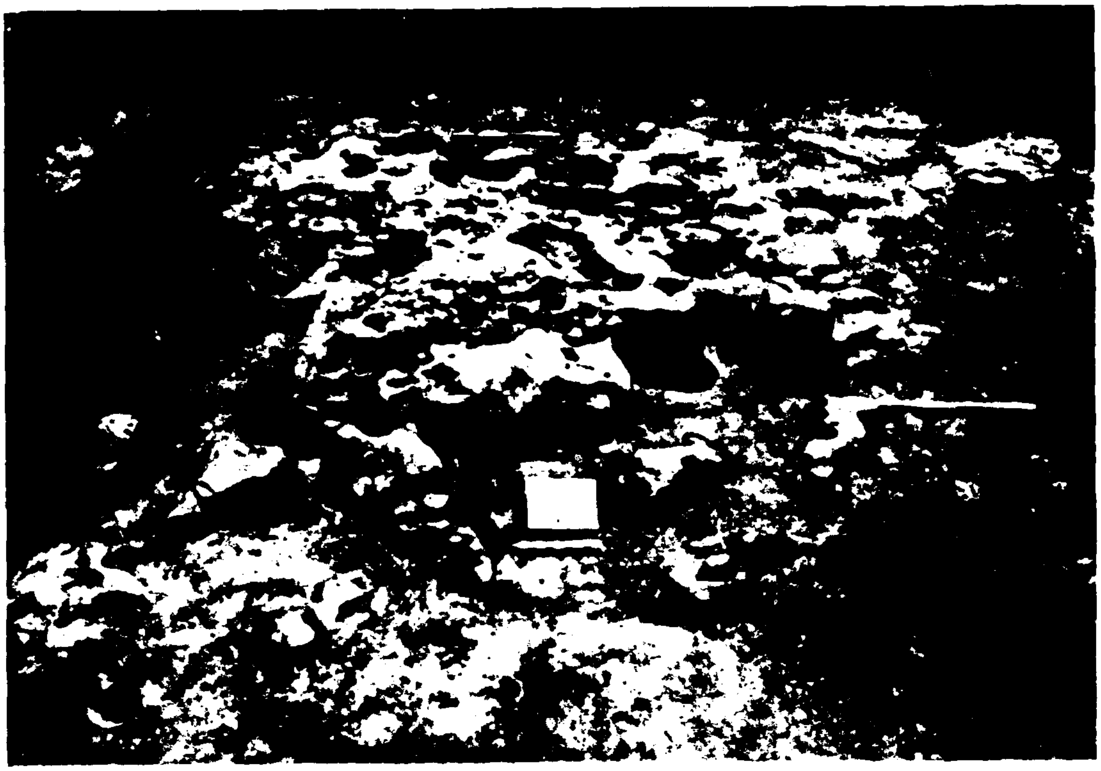


Figure 7 Prepared Area: Feature 120 in Block C, 22It539.

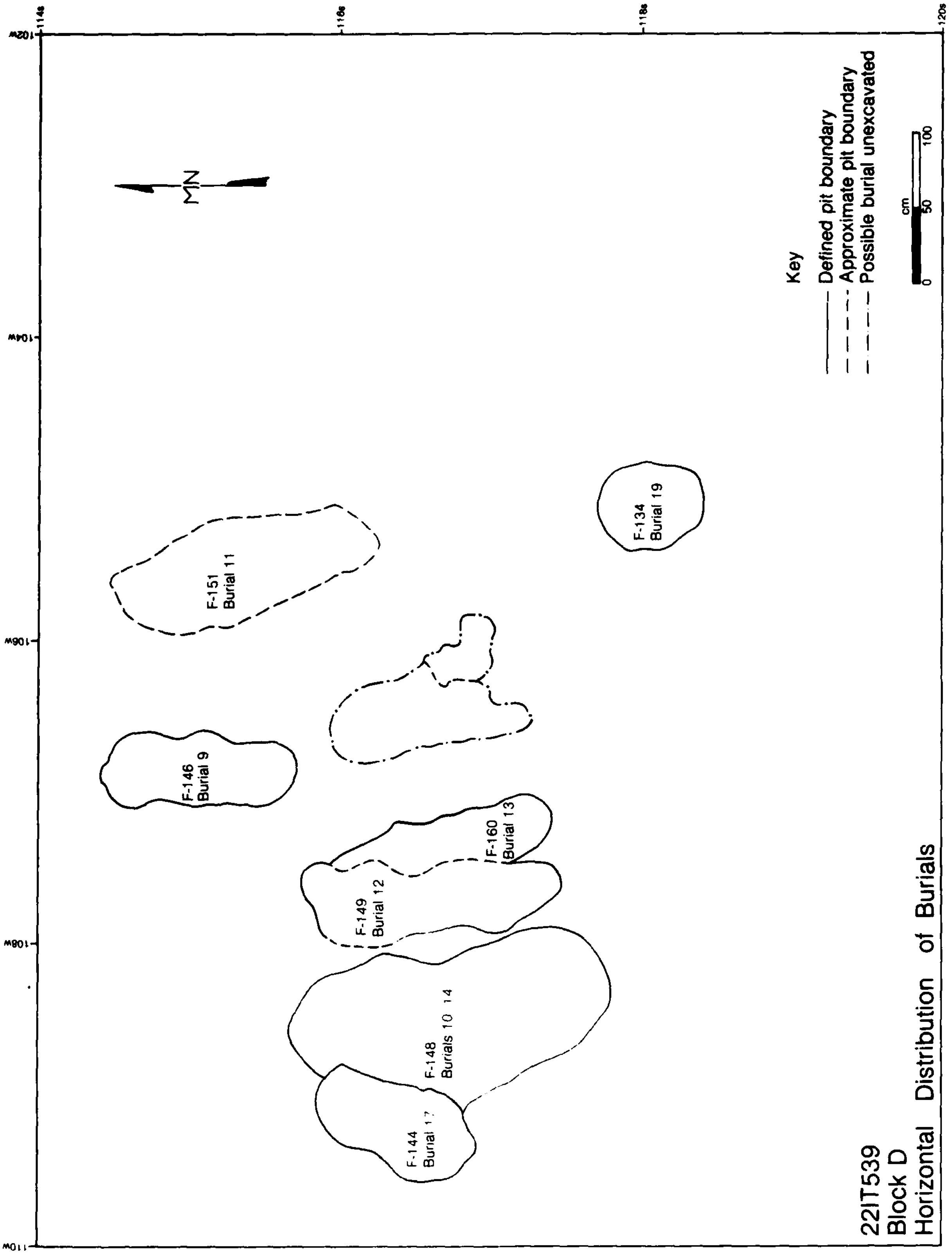


Figure 8 Plan of burials in Blocks A and D, 22It539.

Figure 9 Burial 1 in Block A, 22It539.

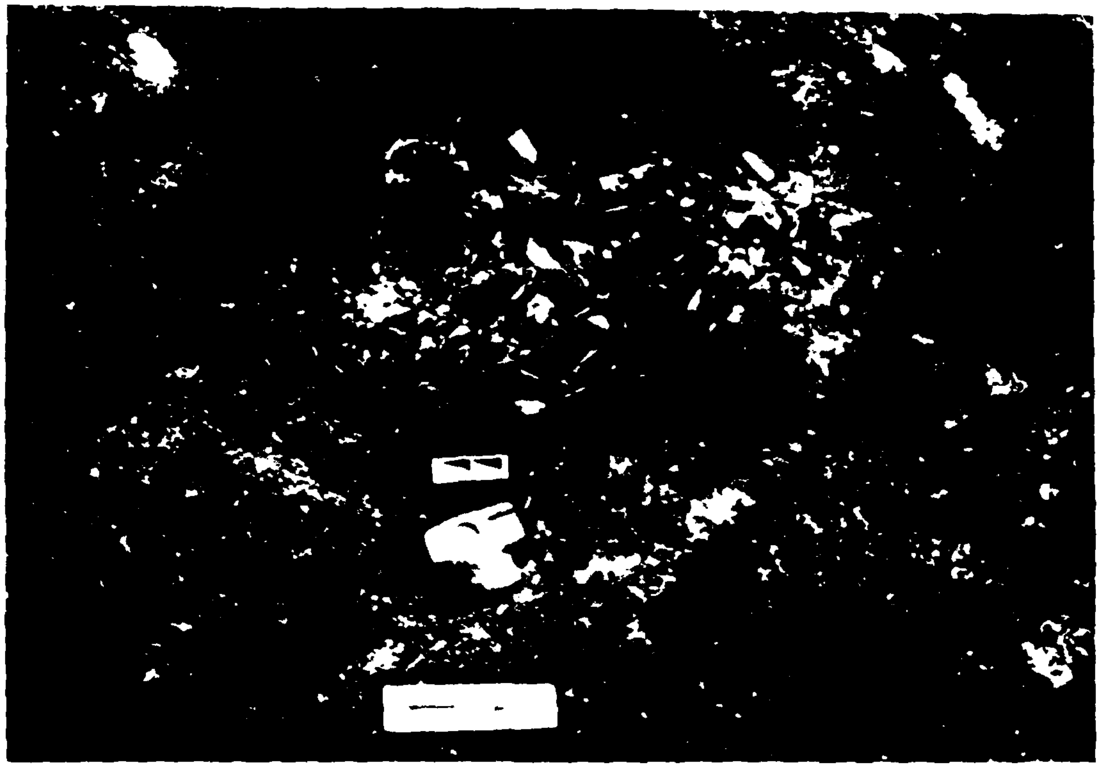


Figure 10 Cremation with stone effigy beads in Block D, 22It539.

The cremation in the Block D burial area (Figure 10) was a well-defined, charcoal-rich area approximately 50x60 cm (1.6x2.0 ft) and 28 cm (11 in) thick which contained fragments of burned bone, apparently from a child, along with three grooved stone effigy beads, including one of a crested bird.

Skeletal preservation was extremely poor, making age and sex determination difficult. The age and sex of only four burials could be determined (Table 14). These included one 30-year-old female, one 40-year-old male, one "adult" male, and one "young" male or female. Four other adults and one youth of indeterminate sex were identified.

Artifacts were associated with four burials. The most definite associations were with Burial 9 in Block D (one muller/pitted anvilstone, one hammerstone, one muller/hammerstone), Burial 11 in Block D (one Sykes-White Springs projectile point/knife and two projectile point/knife fragments), and Burial 19 in Block C, a cremation, (one zoomorphic, one tubular, and one discoidal stone bead). Burial 5 in Block A contained a concentration of small quartzite pebbles near the chest cavity which could have been part of an organic-cased rattle. Several other burial pits had artifacts in the fill not associated with the body.

STRATIGRAPHY

Seven major zones described in Figure 11 were recognized at the Walnut site. The strata were relatively level in the central two-thirds of the site, while on the outer one-third they were occasionally pinched out or had a downward dip. The strata were thickest in the central two-thirds of the site. The profile was characterized by an upper dark midden zone 1.3-1.5 m (4.3-4.9 ft) thick composed of smaller depositional units. The lower portion of the profile was a yellow-brown sandy paleosolic loam with a single recognizable depositional unit (VII).

CHRONOMETRIC DATING

Eleven radiocarbon dates were obtained from this site (Table 15). With one exception, all samples produced radiocarbon determinations of between 8,000 and 5,000 B.P. The one sample from mixed provenience yielded a date of 4,594 B.P. The remaining dates correlated reasonably well for the Eva/Morrow Mountain, Sykes-White Springs, and Benton occupations.

TABLE 15
Radiocarbon dates, 22It539.

Lab #/ Field Number	Block/ Level	C-14 (BP)	Uncorrected (Corrected) Calendar Age (BP)	Archaeo-magnetic Date	Material	Cultural Affiliation
DIC-1955/ 539-1446	A/3	4594±95	2644 (2980-3010)		nutshell	Late Archaic: Little Bear Creek
DIC-1954/ 539-1568	A/7	5706±75	3756 (4440)		nutshell	Benton?
DIC-2006/ 539-2939	B/6	5335±75	3385 (4000)		nutshell	Benton

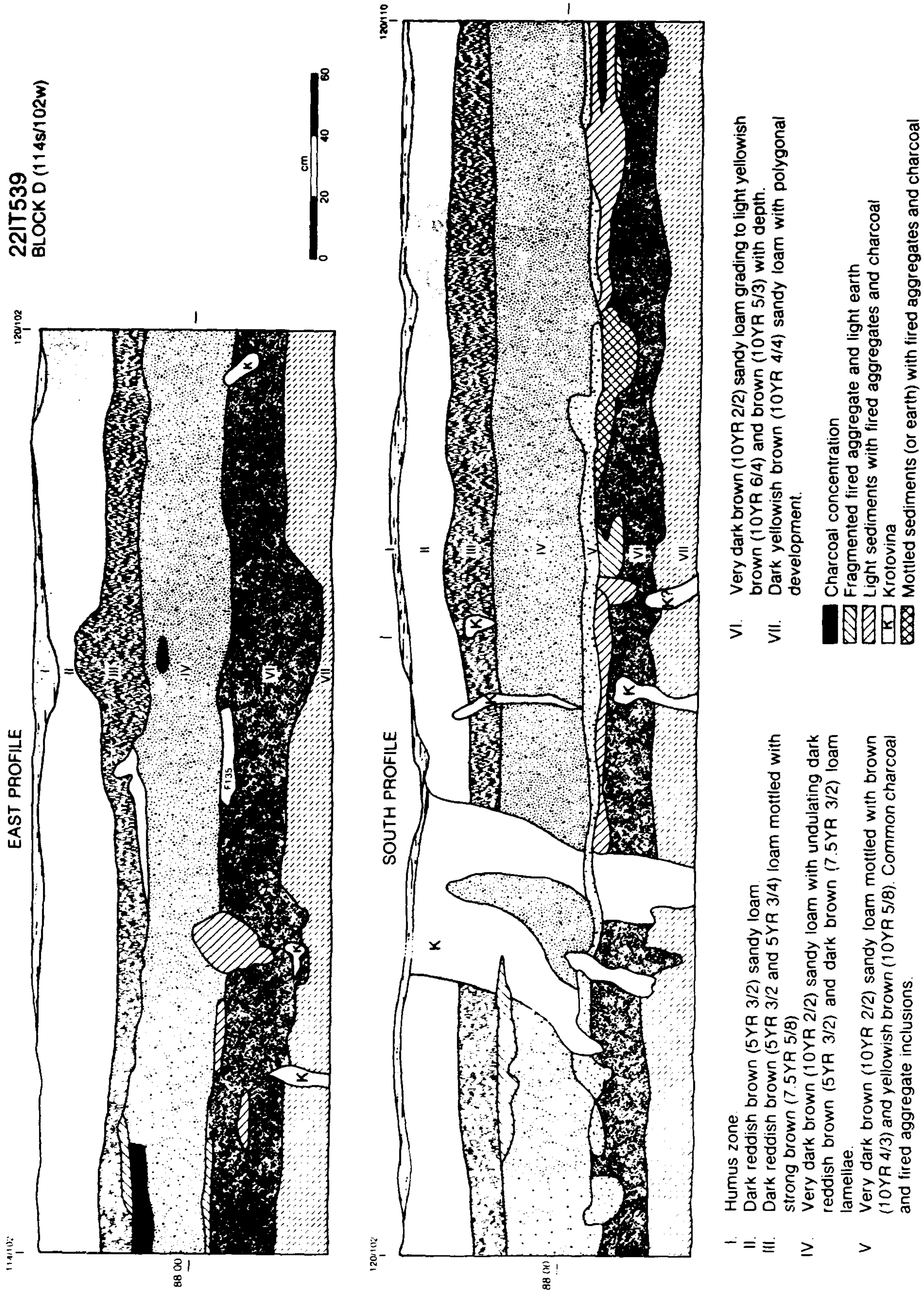


Figure 11 Stratigraphic profile of Block D, 22It539.

TABLE 15

Radiocarbon dates, 22It539 (continued).

Lab #/ Field Number	Block/ Level	C-14 (BP)	Uncorrected (Corrected) Calendar Age (BP)	Archaeo-magnetic Date	Material	Cultural Affiliation
DIC-2007/ 539-3069	B/6	5490±70	3540 (4210-4260)		nutshell	Benton
DIC-1953/ 539-3278	A/12	5902±115	3952 (4580)		nutshell	Sykes-White Springs/Benton
DIC-1952/ 539-4589	A/16	7303±95	5353 (5930)		nutshell	Eva/Morrow Mountain
DIC-1950/ 539-5476	C/Fea 120	6149±96	4199 (4920)		nutshell	Sykes-White Springs
DIC-2081/ 539-5758	D/17	6242±70	4292 (5010)		nutshell	Eva/Morrow Mountain
DIC-1951/ 539-6008	D/Fea 142	5552±155	3602 (4330-4350)		nutshell	Benton
DIC-2082/ 539-6095	D/ Bu 11	7468±85	5518 (6100)		nutshell	Eva/Morrow Mountain
DIC-2008/ 539-6119	D/ Bu 19	5809±245	3859 (4500)		nutshell	unknown

a = Corrections calculated based on Masca curve (Ralph et al. 1973).

The tightest date range was the Benton component and associated features. Four dates bracket the Benton occupation between 5,796 B.P. and 5,335 B.P. Two dates were obtained from two separate strata within prepared area Feature 6 which average 5,490 B.P. and are within ten years of overlapping at the one sigma level. A stratified Benton pit (Feature 142) was dated at 5,532 B.P.

Feature 120, a Sykes-White Springs prepared area from Block C, dated 6,149 B.P. The Eva/Morrow Mountain zone in Block A dated 7,303 B.P. A corresponding Eva/Morrow Mountain level in Block D, however, dated 6,242 B.P. This anomalous reading is probably spurious. One Eva-Morrow Mountain burial (11) in Block D dated 7,468±85 B.P. which agrees with the midden date in Block A.

A nearby burial (12), which contained no grave goods, had charcoal from the pit fill which dated to 5,809 B.P. This date is consistent with the origin of the burial pits and grave goods in other associated burials.

All four radiocarbon dates associated with the Benton occupation were within the 6th millennium B.P. The two Sykes-White Springs dates average about 500 years older and cluster around 6,000 B.P. Two of the three Eva/Morrow Mountain dates, averaging 7,385 B.P., agree with outside dates. The one Late Archaic date of 4,594 B.P. is associated with Little Bear Creek.

A total of 16 archaeomagnetic samples from nine fired clay features from the Walnut site were submitted for dating. The features selected had firm diagnostic temporal markers associated, and most had a radiocarbon date.

Of the 16 samples submitted from nine features, dates were obtained from 12 samples from six features (Table 16). These 12 date ranges were 30-40 years, well within the standard acceptable range of variation (or dispersion) for archaeomagnetic dates. Samples from four features had dispersion ranges too great to be acceptable for dating purposes. The dated features consisted both of small isolated fired areas (hearths or fired aggregates) and the hearths within the large prepared areas.

TABLE 16
Archaeomagnetic and correlating radiocarbon dates, 22It539.

Feature	Component	Elevation	Archaeo-magnetic Dates (±50)	Radiocarbon
95	Sykes-White Springs	88.16	6,300	5,909±115 (10 cm above feature)
120				
ST 23	Sykes-White Springs/ Benton	88.24-88.14	6,250	
ST 19		88.21-88.27	6,200	
ST 22		88.34	6,150	
ST 2		88.2-88.1		6,149±95
ST 16		88.34	6,050	
111	Benton	88.57	6,000	
73	Sykes-White Springs/ Benton	88.34-88.27	5,950	5,706±75 (10 cm above feature)
6				
ST 9		88.26-88.20	5,850	
ST 7		88.35-88.34	5,800	
ST 5		88.38-88.18		5,490±75
ST 2	Benton	88.41-88.30		5,335±75
ST 8		88.40-88.35	4,500	
ST 6		88.54-88.41	4,450	
ST 1		88.53-88.48	4,300	
121		(very large dispersion)		
108		(very large dispersion)		
121		(very large dispersion)		
119		(very large dispersion)		

In Feature 120, the largest prepared area with a 2 m (6.6 ft) wide hearth complex in the center, there were two areas of double-layered fired clay separated by only 50 cm (1.6 ft) (Figure 7). Archaeomagnetic dates of the northeastern hearth area revealed that the last firing of the basal strata dated to 6,250 B.P. and the last firing stratum directly above it, was 6,200 B.P. The last firing of the lower stratum in the central hearth was 6,150 B.P. and the last firing of the stratum above it was 6,050 B.P. The radiocarbon date from this feature was 6,149±95 B.P., suggesting that the charcoal deposit likely was from this hearth.

Vertical zonation of dates in the feature were stratigraphically synchronous. The sequence of dates indicates that this hearth complex grew higher during the 150 years of use. Although there was some overlap in elevation of Strata 19 and 23, Stratum 19 was resting on top of Stratum 23, and the deposits were not level.

The archaeomagnetic and radiocarbon dates document that Feature 120 was a Sykes-White Springs/Benton prepared area and that the hearths were used sequentially, not contemporaneously. This supports an interpretation that this hearth area was the center of activity for an extended period of time (200 years) and that the average use-life for each hearth (or fired aggregate) was approximately 50 years. This feature was probably the center of a residential area which was used or reused continuously for several generations. The hearths were made of silt loam which had been brought onto the site from adjacent wetlands. The continual rebuilding of these four hearths in a small area (2x4 m/6.6x13.2 ft) resulted in a buildup of material which produced a dome-shaped, chronologically ordered feature. The dense and thin feature (15-17 cm/5.9x6.7 ft) grew at an average rate of 5.7 cm (2.25 in) per 50 years.

The other prepared area with multiple hearths, Feature 6, was also archaeomagnetically dated. It was situated approximately 14 m (46.2 ft) southeast of Feature 120 on the south edge of the surface of the landform in Block B. The presence of many Benton projectile point/knives suggested that it was younger than Feature 120. There were five fired aggregates or hearths in an oval plan in this feature, each consisting of only one layer of fired clay. Four archaeomagnetic and two radiocarbon dates ranging between 5,850 and 4,300 B.P. were obtained from this feature (Table 17). The date range documents that the two prepared areas were not in use at the same time and that Feature 6 was initiated 150 years after the cessation of firing in the hearths in Feature 120.

The two northernmost hearths (Strata 9 and 7) were the oldest. Stratum 9 was last fired 5,850 B.P. and Stratum 7 was last fired in 5,800 B.P. The three other hearths (Strata 8, 6, and 1), clustered at the south end of the feature, were fired 1,300 years later. These hearths dated 4,500, 4,450, and 4,300 B.P., respectively. The two radiocarbon dates of 5,335±75 and 5,490±75 B.P., respectively came from charcoal-rich Strata 2 and 5 beneath the hearths.

Interpretation of the six dates from this feature is difficult. First, if all dates are accurate, this area was in use for 1,850 years, with a hiatus of 1,300 years between the use of the northern two hearths and the southern three hearths. If so, the hearths are not related and actually are not parts of the same phenomenon. The older northern hearths were lower than the southern hearths (Table 17) and could have been buried when the use of the later ones was initiated. However, the top of Stratum 7 (5,800 B.P.) and the bottom of Stratum 8 (4,500 B.P.) are within 1 mm of elevation, perhaps invalidating this reasoning.

An alternative interpretation of the long time gap between firings is that the archaeomagnetic dates for the southern three hearths are incorrect. Two lines of evidence support this interpretation. First, the composition of the feature strata documented that it was one entity. The close proximity of the five hearths (within a 2 m or 6.6 ft area), as well as the presence of contiguous underlying strata, indicate that this feature was one activity-related phenomenon. Clearly, a gap of 1,300 years is too long for related activities to take place. Second, the radiocarbon and the archaeomagnetic dates of the northern hearths fall within a 650-340 period of time (5,900 and 5,250 B.P.) which is well within the documented range of the Benton horizon (see Chapter II) and indicative of a shorter, more continuous use of the hearth complex. The younger archaeomagnetic dates for the southern three hearths of Feature 6 are out of the documented chronological span of the Middle Archaic Benton horizon by at least 700 years. Therefore, it appears that these dates are in error.

From the dating of the hearths of Feature 6, it appears that this also was an area of concentrated residential activities. The date ranges indicate that the two large residential areas were not contemporaneous. Not all of this site was investigated, however, and more of these features could exist.

Three additional hearths were dated at the Walnut site. Two were isolated within the midden matrix (Features 95 and 11), and one (Feature 73) was a prepared area with features. Of these, Features 95 and 73 were in Block A on the southeastern part of the landform. Feature 95 was associated with Sykes-White Springs temporal markers and archaeomagnetically dated to 6,300 B.P. Forty centimeters (15.7 in) above this feature in the Benton component, another hearth associated with the prepared area (Feature 73) was dated archaeomagnetically to 5,950 B.P. A radiocarbon date of 5,706±75 between these two hearths agrees with the bracketing dates. An additional radiocarbon date of 5,706±75 was obtained from midden 10 cm (3.9 in) above Feature 73. These separate dating methods verify each other on unrelated hearths from two temporally separate cultural components.

Feature 111 was a hearth in Block C, the same unit as Feature 120. However, Feature 111 was situated 20 cm (7.8 in) above the highest part of Feature 120. The archaeomagnetic date of the fired clay was 6,000 B.P., which agrees well with the Benton cultural affiliation of the surrounding midden.

Except for the three young dates from Feature 6, the archaeomagnetic dates from the five features agree with the radiocarbon dates and the associated diagnostic cultural markers.

SUMMARY

The Walnut site was a multi-component site on a large natural elevation in the floodplain of the headwaters of the Tombigbee Valley. The site was occupied for at least the last 10,000 years to the present. Four large excavation units and four stratigraphic trenches produced a good sample of the material and features left behind by previous occupants. Following is a brief summary of the site in terms of archaeological components and intra-site patterning and activities at the site.

Archaic Stage: The recovery of two Dalton points indicates that an early occupation could have occurred (11,000-10,000 B.P.) prior to the documented Early Archaic occupation. However, these projectile point/knives were recovered out-of-context and could not be associated with a Dalton occupation at this site.

The Early Archaic was the first period of occupation here and was identified by the presence of Big Sandy and Kirk Corner-Notched hafted bifaces in the upper portion of the paleosol soil (Zone VII). The apparent diffuse nature of the occupations, as well as intensive Middle Archaic utilization of the site, precluded a clear separation of the Early Archaic component. The activities probably included biface manufacture, tool maintenance, and rejuvenation. The Early Archaic occupations were probably made by small groups on an intermittent seasonal basis, and the site was used for specialized extraction during the time period from 10,000-8,500 B.P.

Distinctive stemmed corner-notched hafted bifaces provide enough evidence to define the cultural component which follows tentatively as "Cypress Creek." There is the possibility, however, that these hafted bifaces could belong with the Eva/Morrow Mountain occupation. Stratigraphically, however, they appear to be Late Early Archaic or Early Middle Archaic from ca. 8,500-8,000 B.P.

The Middle Archaic Eva/Morrow Mountain occupation of the site was much more substantial than previous occupations. The term Eva/Morrow Mountain is used here to reflect consistent co-occurrence of these markers and blending of the attributes of both into one projectile point/knife form.

Prepared areas, representing focal points of activity, first appear in the Eva/Morrow Mountain occupation of this site. Although they are less well defined and perhaps somewhat smaller in size than those of the later Sykes-White Springs and Benton periods, they nonetheless indicate that these activities were initiated. Specific tasks at these areas included the procurement and reduction of local Camden chert cobbles into finished tools involving heating the chert, cobble reduction via hard hammer and soft hammer percussion, and producing flake blanks from the cobble cores. These were then heated and further reduced by soft hammer percussion.

One of the most distinguishing aspects of the Eva/Morrow Mountain assemblage is the ubiquity of flake tools such as hafted end scrapers and side scrapers. The variety of flake tools included several kinds of scrapers on flakes. Flake blanks were generally expanding to amorphous in form; however, some were blade-like. A variety of other chipped and ground stone tools was also found. The large amounts of fired aggregates, burned sandstone, charcoal, fire-cracked chert, and a diversified tool kit suggest a substantial occupation.

The Eva/Morrow Mountain tool assemblage suggests that a variety of extractive and maintenance tasks were carried out on the site, probably in association with the prepared areas. Such tasks seem to have involved hunting, fishing, and turtling as well as processing the material from these outings. Evidence for tool manufacture and use is present with a full complement of implements present.

Another important aspect of the Middle Archaic (Eva/Morrow Mountain? or the later Sykes-White Springs/Benton) occupations was the presence of two organized burial areas located in separate sections of the site. The layout and arrangement of the cemeteries suggest a community plan which involves the segregation of secular and ritualistic activities. The 7,468±85 B.P. date from Burial 11 and the 5,809±245 B.P. date from cremation (Burial 19) provide inconclusive evidence for developing chronological and cultural associations in the cemeteries.

Prepared areas as focal points of activity continued during the succeeding Sykes-White Springs occupation. The large prepared area, Feature 120, contained four separately fired hearths suggesting repeated usage for 200 years. As in the Eva/Morrow Mountain zone, there is an indication of multiple tasks carried out on the site; however, the incidence of early stage biface manufacture is somewhat diminished. The relatively large amount of bone recovered in Block C, apparently in association with the large prepared area, suggests that the occupation was semipermanent during the summer through fall months. This is speculative, and more sensitive seasonal indicators, along with better contexts, are needed to make such a determination.

Two inhumations were recovered in Block C in the immediate vicinity of the prepared area. The level of origin of the pits for the interments, however, is not clear. It appears that semipermanent or permanent occupation(s) occurred during Sykes-White Springs times. The presence of large prepared areas and a diversified tool kit suggest a base camp utilization for the Walnut site locale during this time period. It appears that between 6,500 and 6,000 B.P. the Sykes-White Springs culture progressed smoothly into the Benton.

The Benton component(s) at this site provided the best information concerning site patterning, subsistence, technology, and overall cultural placement. This occupation dated from 6,000-5,300 B.P. The data support the contention that the prepared area in Block B was a focal point of the Benton occupation. Chemical and physical analysis support the contention that introduced sediments were used to construct all prepared areas. The distribution of tools on and around the prepared area indicate that activities such as tool manufacture and rejuvenation took place. Processing of animals and plants also appears to have occurred. Although faunal remains were virtually absent, this apparently is more a function of preservation than cultural practices. The presence of charred hickory nutshell and wood charcoal, along with the fired aggregates, suggests that burning was common, probably related to food processing. The ubiquity of the Benton projectile point/knife form, possibly multipurpose tools, and the numerous fragments manufactured from Fort Payne chert indicate intensive rejuvenation activity.

Artifactual remains of the Middle Archaic coupled with high numbers of pits, organized burial areas, and hearths indicate that the Walnut site was a multiple activity locus during Middle Archaic times. It suggests strongly that the site was used as a permanent or semipermanent base camp during this time period. The primary season of habitation may have been during the summer and fall. A floodplain site is more tenable during low-water periods. Further, the abundance of hickory nutshells recovered and the types of aquatic resources taken suggests fall occupance.

The Late Archaic occupations of the Walnut site are not well understood from the recovered materials. There is a distinct possibility that an occasional Ledbetter-Pickwick occupation occurred from 5,000-3,500 B.P.; however, no inferences concerning activities or patterning can be made. Little may be inferred from this occupation except that there appears to have been a major shift in biface technology involving the use of local heated Camden chert in the manufacture of projectile point/knives and other tools. It appears that the site was less intensively occupied than in preceding Archaic occupations. It may have been a special activity locale or a semipermanent camp during this time period.

Woodland and Mississippian Stages: The deposits of the post-Archaic prehistoric occupations at Site 22It539 had been disturbed so that vertical separation was not possible. Horizontal separation, with some patterning, was evident from the location of temporal ceramic types. Two possible Middle Woodland components were detected: one with limestone-tempered vessels on the northwest section of the site (Block C) and one without limestone-tempered ceramics on the south portion of the site (Blocks A and B). Two possible Late Woodland/Mississippian components were identified. The component containing shell-and-grog-tempered ceramics was located on the north side of the site (Block C), and the component containing primarily grog-tempered ceramics was located on the southern end of the site (Blocks A and B). The Gulf Formational component appears to have utilized the entire site area relatively uniformly.

The ceramic types recovered at 22It539 indicate that most of the post-Archaic components previously encountered in the Upper Tombigbee Valley were present here. These include the Middle Miller I, Pharr subphase (A.D. 100-400) and possibly Gainesville subphases (A.D. 900-1,100); the Late Miller III, Catfish Bend subphase (A.D. 900-1,100); and the Early Mississippian (A.D. 1,200-1,300) (Jenkins 1982).

EXCAVATIONS AT THE ILEX SITE (22It590)

The Ilex site was in northern Itawamba County along Mackey's Creek, a tributary to the headwaters of the Tombigbee River (Figure 1). The site was on the first terrace adjacent to the juncture of the southern valley wall on the floodplain of the Mackey's Creek valley. The site landform was a relatively flat terrace which was tangent to the high Pleistocene ridge on the south portion of the site prior to separation by a small stream. The site was bordered by Mackey's Creek on the north and west and a swamp on the east (Figure 12). The site was approximately 100x60 m (330x198 ft) in size and was up to 2-3 m (6.6-9.9 ft) above the lowlying floodplain. The Pleistocene ridge which forms the southern boundary of the site exhibited slumping, sheet erosion, and mass movements of sediments.

FIELD METHODS

The Ilex site was initially recorded by Blakeman (1976:19), who considered the site to be significant based on the presence of Transitional Archaic/Woodland, Woodland and Mississippian components identified from a surface collection. The site was recommended for testing, and this was performed in 1979 (Bense 1982). Testing included two 2x2 m (6.6x6.6 ft) units and a complete site profile which confirmed Blakeman's results and, in addition, identified in situ Archaic components (Bense 1982:430).

The excavation at this site was preceded by more extensive preliminary investigations than had been employed previously to aid in the placement of block excavation units. These efforts included: 1) three stratigraphic backhoe trenches, 2) a series of 1x1 m (3.3x3.3 ft) test units along the stratigraphic trenches to correlate cultural and natural strata, 3) several 1x2 m (3.3x6.6 ft) test units in areas between the stratigraphic trenches, and 4) visual cores on an 8 m (26.4 ft) grid pattern.

The stratigraphic trenches exposed representative profiles of the site without disturbing the majority of the central site area. The initial stratigraphic trenches (1 and 2) were placed along the exposed eastern and northwestern borders of the site (Figure 12). Trench 3 transected the southern part of the site. Trenches 4 and 5 were excavated later to investigate the central and southwestern area of the site.

The test units consisted of 12 1x1 m (3.3x3.3 ft) units placed adjacent to stratigraphic trenches. Eight additional 1x2 m (3.3x6.6 ft) test units throughout the site area were also excavated. Excavation was in arbitrary 10 cm (3.9 in) levels.

Chemical coring techniques were not employed at 22It590, because the results at the Walnut and Poplar sites had been inconclusive. The stratigraphic trenches and test units, supplemented by an 8 m (26.4 in) visual coring grid, provided much more useful information.

The strategy for subsequent excavations stressed problem-oriented research. The pragmatic placement of excavation units to address specific research problems was facilitated by these preliminary investigations at the site. The final excavation strategy stressed recovery of the early components at the Ilex site. However, evidence for all cultural components encountered was scrutinized in an attempt to determine the relative integrity of recovered materials and their interpretive significance.

The excavations at Ilex included five stratigraphic trenches, nine 4x4 m (13.2x13.2 ft) blocks; one 4x8 m (13.2x26.4 ft) and one 2x2 m (6.6x6.6 ft) unit; 12 1x1 m (3.3x3.3 ft) test units and eight 1x2 m (3.3x6.6 ft) test

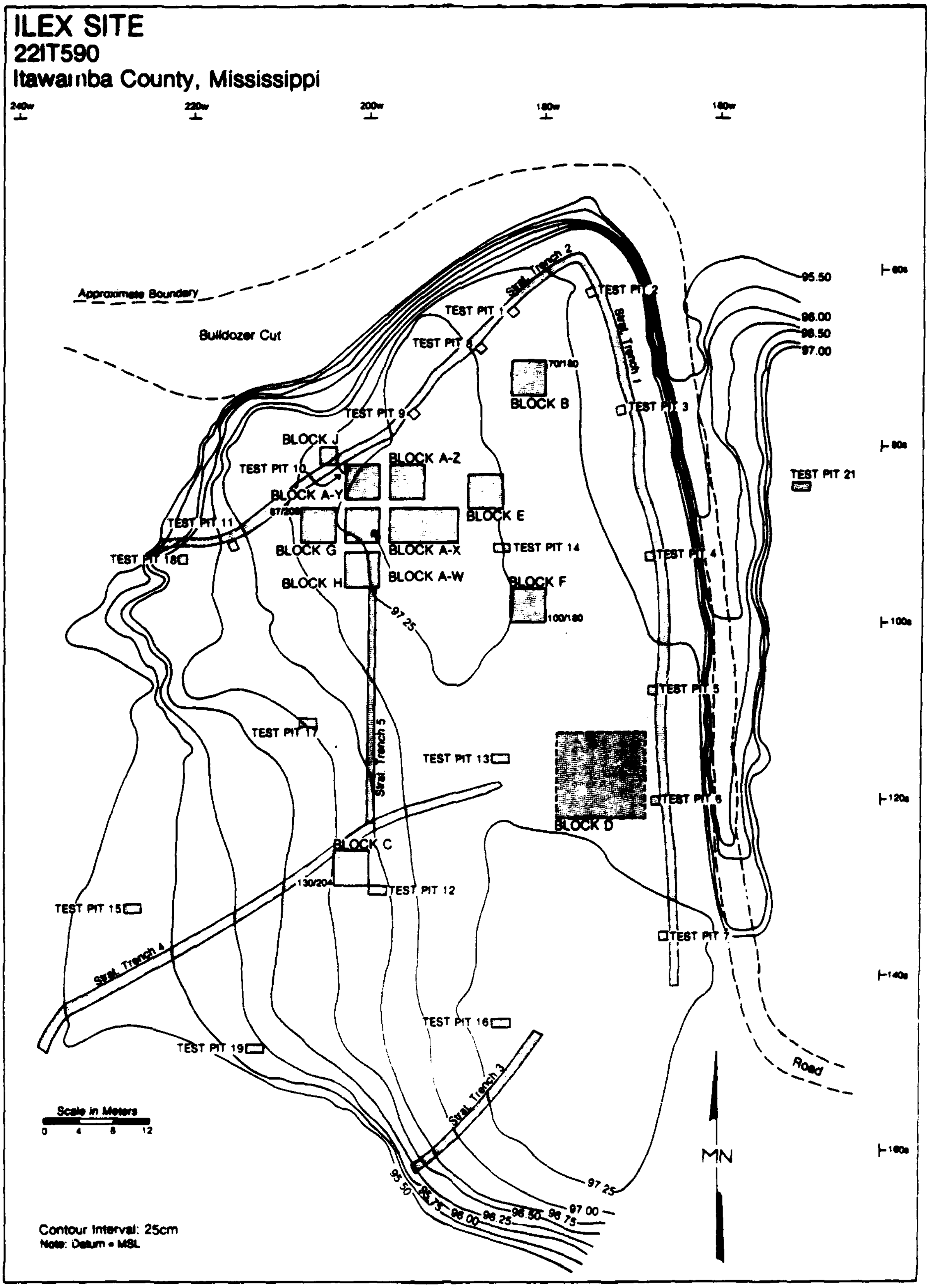


Figure 12 Topographic map and excavation plan, 22It590.

units. As can be seen in Figure 12, the major area of excavation was in the north-central part of the site. Here, seven major excavation blocks were separated by a 1 m (3.3 ft) balk used to aid in stratigraphic control. This area is designated as the "Master Block" and is equal to approximately an 8x16 m (26.4x52.8 ft) excavation unit. In most units, the upper mixed midden was removed at the site and tossed. However, in Blocks A-Z, B, and J, the entire sequence was screened and all material recovered. Block D was a 10x10 m (33x33 ft) unit, however, in this unit, the upper mixed midden was stripped off, and the features were mapped and excavated.

CULTURAL REMAINS

A total of 5,995 ceramics were recovered from the Ilex site. Based on the temper and typology of the recovered specimens, the site was occupied throughout the Gulf Formational to Mississippian stages. As at the other midden mounds investigated, attempts to provide a chronological ordering of ceramic-bearing occupations were largely unsuccessful. The ceramics were largely confined (97-98%) to the upper 40 cm (1.3 ft) of the profile. In most units, the shell-tempered specimens were confined to the upper 20 cm (7.8 in), and the grog-tempered were confined to the upper 30 cm (11.7 in). However, the older limestone, sand, and fiber-tempered sherds were thoroughly mixed throughout the ceramic-bearing zone. This is likely due to the slow rate of vertical site accretion, intense use of the site by ceramic-using occupants, and recent extensive looting.

All known temper types are represented in the sample (Table 17). Sand-tempered sherds dominate the sample (66.2%) followed by fiber-tempered (20.4%). Late Woodland (grog- and bone-tempered) and Mississippian (shell-tempered) ceramics are very low in frequency at this site and amount to only 8.3% of the ceramic inventory. The surprisingly high amount of fiber-tempered ceramics (1,225; 20.4%) represents the highest proportion of such ceramics of any assemblage reported in the Upper Tombigbee Valley. Perhaps the location of this site nearest the divide (16 km or 10 mi) with the Middle Tennessee Valley, where Wheeler fiber-tempered ceramics developed, is significant. The Late Gulf Formational ceramic assemblages (Alexander series) were approximately half as frequent as the Wheeler (621 or 10.4%). The limestone-tempered sherds were also more frequent (5%) at this northernmost project site and may be another indicator of interaction with the Middle Tennessee Valley.

TABLE 17
Ceramic frequencies by temper, 22It590.

Temper	Frequency	Percentage
Shell	117	1.9
Shell-Grog	26	0.4
Grog	329	5.5
Bone	29	0.5
Limestone	300	5.0
Sand	3,969	66.2
Fiber	1,225	20.4
Total	5,995	

A total of 5,049 chipped stone implements were recovered from this site (Table 18). While 46.7% of the chipped stone was so fragmented that the tool type was unidentifiable, projectile point/knives (complete and fragments) comprised 21.1% and were more frequent than at any other site investigated. Other tool types included bifaces (4.7%), preforms (9.9%), cores (4.7%), scrapers (6.2%), drills, perforators, and other small tools (3.8%).

TABLE 18
Chipped stone tool frequencies by type, 22It590.

Category	Frequency	Percentage
Projectile Point/Knives		
Beaver Lake	1	
Benton	58	
Big Sandy	6	
Cotaco Creek	10	
Cypress Creek	11	
Dalton	5	
Eva	11	
Gary	9	
Greenbriar	21	
Hardaway	1	
Kirk Corner-Notched	31	
Late Woodland/Mississippi Triangular	22	
Ledbetter Pickwick	16	
Little Bear Creek/Flint Creek	86	
McIntire	11	
Morrow Mountain	9	
Residual Stemmed	94	
Sykes-White Springs	20	
Tombigbee Stemmed	4	
Vaughn	2	
Distal Fragment	276	
Medial Fragment	170	
Proximal Fragment	168	
Unfinished Small Triangular	3	
Residual Triangular	9	
Plevna	4	
Beachum	9	
Subtotal	1,067	21.1
Bifaces	236	4.7
Cores	237	4.7
Preforms	458	9.9
Scrapers	315	6.2
Drills, Perforators, etc.	191	3.8
Other Uniface and Biface Tools	2,545	50.4
Total	5,049	

Utilized flakes were a frequent expedient tool type used at the Ilex site. A total of 5,557 were recovered. A total of 85,091 non-utilized flakes were recovered. Heated and unheated Camden chert dominated the debitage (92%). Within the combined Camden size grades, heated material predominates (77%). The dominance of Camden chert during all periods of occupation at 22It590 conforms to a pattern recognized throughout the Upper Tombigbee Valley. Fort Payne chert was the most frequent minority type comprising 4% of the debitage with other types constituting less than 4% of the debitage.

The size-grade analysis of the debitage indicated a pattern similar to the Walnut and Poplar sites in the correlation between smaller size and higher frequency (Table 19). The one-inch and larger flakes were lowest in frequency (0.4%), the half-inch flakes were more abundant (15.6%), while the smallest size recorded, quarter inch, dominated the debitage (84%). This reflects both the low number of large flakes removed from cobbles in stone tool manufacture and the high amount of manufacturing activity conducted there. A ratio of 1:41:219 of flake size grades was characteristic of this assemblage. The tool-to-debitage ratio was 1:17.

TABLE 19
Size-grade frequencies of debitage, 22It590.

Flake Size	Frequency	Percentage
1.0 inch	325	0.4
0.5 inch	13,289	15.6
0.25 inch	71,477	84.0
Total	85,091	

A total of 580 ground stone specimens were recovered from 22It590 (Table 20). Fifty percent of the sample were too small to identify and another 20% were classified as "other" tool types. The identifiable ground stone tools included food processing, tool manufacturing, and wood working implements, along with composite tools and items of adornment, such as a bead, a gorget fragment, and atlatl weights. The ground stone artifacts were made from conglomerate, quartzite, and ferruginous sandstone.

TABLE 20
Ground stone tool frequencies by type, 22It590.

Type	Frequency
Hammerstone	47
Anvilstone	8
Pitted anvilstone	13
Hammerstone/anvilstone	12
Abrader	9
Muller	12
Mortar	3
Pestle	1
Grooved Axe	1
Gorget	1
Altatl weight	6
Bead	1
Hoe chip	1
Steatite sherd	4
Ground limonite	17
Ground hematite	28
Edge-ground cobble	1
Unidentifiable ground/polished stone fragment	295
Other	118
Muller/pitted anvilstone	3
Drill core	1
Bead preform	1
Abrader/anvilstone	1
Awl	6
Total	590

Introduced rock was abundant at this site (145.6 kg). It consisted primarily of ferruginous sandstone and pebbles.

Faunal remains from 22It590 consisted of a few very small fragments of bone recovered and sorted during the flotation analysis. The poor quality and small number of fragments obviated identification. One dog burial was encountered in a test unit during the 1979 testing (Bense 1982).

Limited numbers (30) of historic/modern artifacts were recovered from 22It590. Most of these items reflect recent land use practices, such as farming, tree planting, and construction. The small heterogeneous samples of ceramics, glass, metal, and miscellaneous debris are probably less than 30 years old.

FEATURES

Sixty-seven features were recorded at the Ilex site and included:

7 rock clusters
1 bone cluster
1 complex cluster
2 fired aggregates
51 pits
5 prepared areas

Pits were the most numerous feature type, and the vast majority contained the same kinds of cultural materials found in the surrounding midden. Pits generally were characterized by the dark color of the internal fill which contrasted with the lighter color of adjoining sediments. Oxidized sediments and carbonized organics, commonly found in pit fills provided evidence of burning.

The cultural affiliation of only six of the pits was determinable. Usually the pits contained no temporally sensitive material or had mixed temporal markers, due to digging activity. Of the six pits with either temporal markers or good stratigraphic association, two were associated with the Early Archaic, two with the Middle Archaic, and two were probably associated with the Late Archaic period. Pits were usually only identifiable when they contrasted in color with the lighter and deeper strata. Therefore, it is inferred that the upper portions of most pits were included in midden, rather than with feature excavation.

The two fired aggregates at this site were relatively small concentrations of burned earth and appeared to be part of larger prepared area features which either decomposed or were destroyed during subsequent occupation(s). One hearth was located in the Master Block area, one each in Block A-Z and G. However, they could be remnants of large fire hearths. It was difficult to associate specific material with the fired aggregates.

All five prepared areas were encountered in the Master Block units A-W, X, Y, and Z. The condition of these features was poor, however, causing both definition and cultural affiliation problems. A greater diversity of artifacts was recovered from the vicinity of the fired aggregate features. It appears that both fired aggregates and prepared areas were part of larger, prepared living areas. The vertical and horizontal proximity of Features 22 and 23, (Figure 13) supports the proposition that these were remnants of a single prepared area. Only two prepared areas were well defined and could be associated with a cultural component (Benton). Even this association was equivocal. The size of these two features was similar: 1.95x1.66 m (6.4-5.4 ft) long, 2.0x1.5 m (6.6-4.9 ft) wide, and 27 and 28 cm (10.6 and

Figure 13 Prepared Area: Feature 22, 22It590.

11.0 in) thick. These prepared areas had multiple hearths surrounded by a mosaic of yellow and orange deposits (Figure 13). The three other prepared areas had been too disturbed to measure or associate with an occupation of the site.

The seven rock features identified were generally well-defined clusters of fist-sized, ferruginous fragments. Several rocks in each feature appear to have been thermally altered. These rock clusters were likely associated with fire hearths, rock ovens, use areas of convenience tools or general disposal. Cultural materials associated with the rock clusters commonly included burned debris, such as fire-cracked chert, hematite, and fired clay. This implied in situ burning in association with the rock clusters and supported the thesis that these features were connected with fire-related activities, such as hearths or rock ovens. The absence of strong oxidation of soil matrices and ash in association with the clusters suggested rapid weathering and decomposition, post-depositional disturbances, and/or short-term use of these features.

One complex cluster which contained a variety of cultural debris, including burned sandstone cobbles, lithic implements and debitage, and pottery was defined. Evidence of burning and darker internal matrix color were interpreted as indications of a small pit, although boundaries could not be distinguished. The Wheeler sherds associated with this feature appeared to have been from a single vessel. The feature was probably a hearth contained in a small pit.

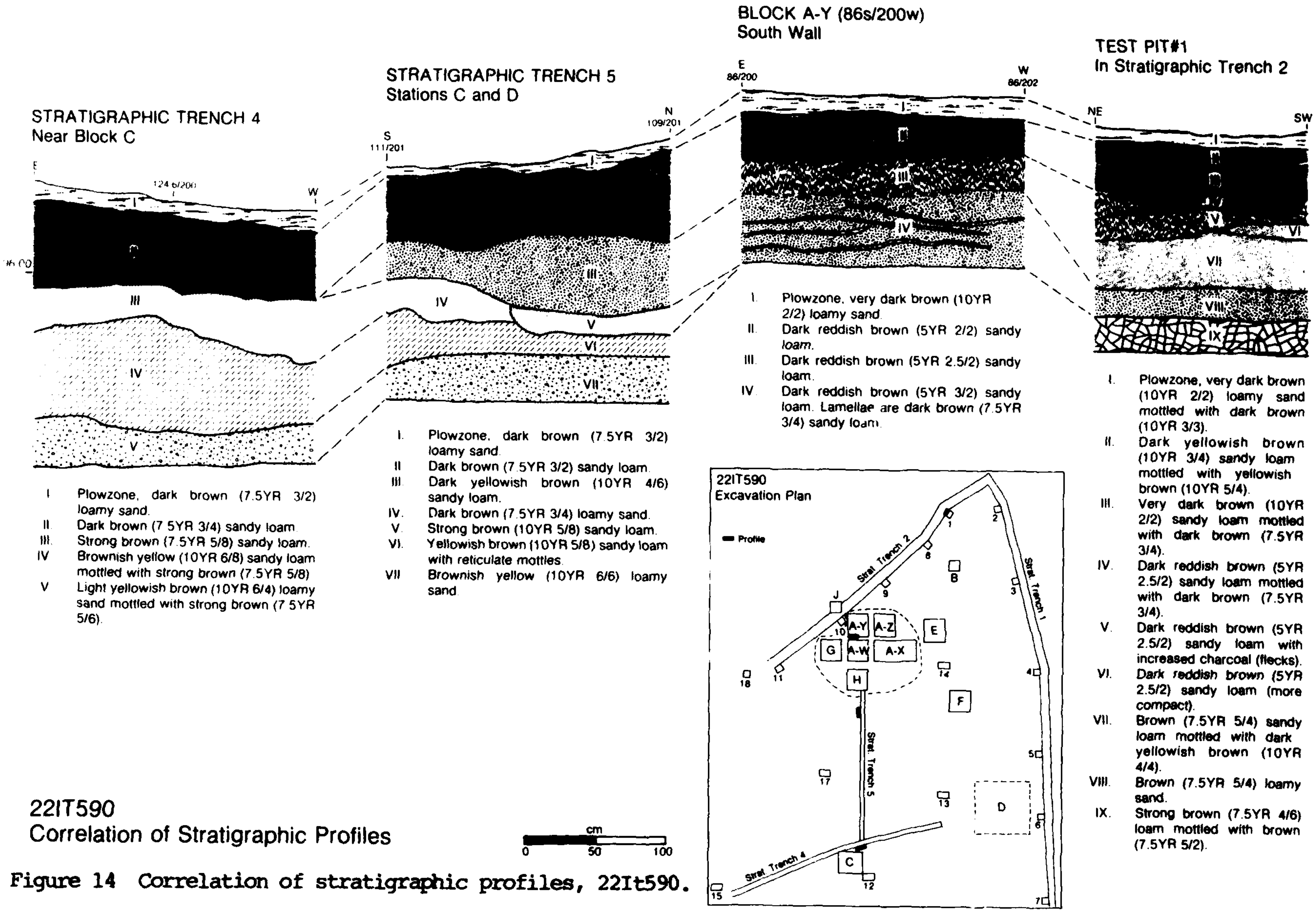
Three features were associated with recent relic digging. These were recognized by stratigraphic interruptions and the presence of historic/recent artifacts. The site surface exhibited a series of such potholes.

Human skeletal remains from the Ilex site were limited to a single occurrence in Block A-X and consisted of several badly decomposed bone fragments. The best preserved of these fragments appeared to be a long bone segment (femur?) that was oriented in an upright position within the deposit. A very faint color change may have marked a pit outline, although the exact boundaries and level of origin of this feature could not be determined. This probably was a secondary burial in a small pit. There were no obvious artifact associations or additional interments in the vicinity of the human bone.

STRATIGRAPHY

The site soils were loams deposited as alluvium from Mackey's Creek through overbank deposition and colluvium from erosion of the adjoining uplands. The site landform appears to have initiated as a terrace fragment outlier in the floodplain, similar to both 22It539 and 22It576. Sands in the site soils were coarser than the sands found at the Walnut and Poplar sites.

Nine strata were identified at the site, but they were not uniformly distributed throughout the site (Figure 14). The upper meter (3.3 ft) (Strata I-III) was darkly stained from organic matter and thinned appreciably to the south. The cultural midden was underlain by massive, undifferentiated sand horizons of varying thicknesses. A subsurface ridge of highly weathered sediments, oriented in a north-south direction, was underlaid the western margins of the site area in Trenches 4 and 5 and in Block C excavation unit. This deposit appeared to be a former terrace, possibly of Pleistocene age. Higher silt and clay fractions and gley colors characterized this terrace remnant. Overlying this deposit was an indurated B horizon that was characterized by strong reticulate mottling.



STRATIGRAPHIC TRENCH 4

- I. Plowzone, dark brown (7.5YR 3/2) loamy sand.
- II. Dark brown (7.5YR 3/4) sandy loam.
- III. Strong brown (7.5YR 5/8) sandy loam.
- IV. Brownish yellow (10YR 6/8) sandy loam mottled with strong brown (7.5YR 5/8)
- V. Light yellowish brown (10YR 6/4) loamy sand mottled with strong brown (7.5YR 5/6).

STRATIGRAPHIC TRENCH 5

- I. Plowzone, dark brown (7.5YR 3/2) loamy sand.
- II. Dark brown (7.5YR 3/2) sandy loam.
- III. Dark yellowish brown (10YR 4/6) sandy loam.
- IV. Dark brown (7.5YR 3/4) loamy sand.
- V. Strong brown (10YR 5/8) sandy loam.
- VI. Yellowish brown (10YR 5/8) sandy loam with reticulate mottles.
- VII. Brownish yellow (10YR 6/6) loamy sand.

BLOCK A-Y (86s/200w)

- I. Plowzone, very dark brown (10YR 2/2) loamy sand.
- II. Dark reddish brown (5YR 2/2) sandy *loam*.
- III. Dark reddish brown (5YR 2.5/2) sandy loam.
- IV. Dark reddish brown (5YR 3/2) sandy loam. Lamellae are dark brown (7.5YR 3/4) sandy loam.

TEST PIT#1

- I. Plowzone, very dark brown (10YR 2/2) loamy sand mottled with dark brown (10YR 3/3).
- II. Dark yellowish brown (10YR 3/4) sandy loam mottled with yellowish brown (10YR 5/4).
- III. Very dark brown (10YR 2/2) sandy loam mottled with dark brown (7.5YR 3/4).
- IV. Dark reddish brown (5YR 2.5/2) sandy loam mottled with dark brown (7.5YR 3/4).
- V. Dark reddish brown (5YR 2.5/2) sandy loam with increased charcoal (flecks).
- VI. Dark reddish brown (5YR 2.5/2) sandy loam (more compact).
- VII. Brown (7.5YR 5/4) sandy loam mottled with dark yellowish brown (10YR 4/4).
- VIII. Brown (7.5YR 5/4) loamy sand.
- IX. Strong brown (7.5YR 4/6) loam mottled with brown (7.5YR 5/2).

Figure 14 Correlation of stratigraphic profiles, 22It590.

Lamellae were common occurrences on the north end of the terrace below ca. 50 cm (1.6 ft). These were generally horizontal, dark-colored bands of variable thickness and appeared to correspond to areas of the site with thick cultural midden deposits. This suggested that the midden was the source of at least some of the clays and organics present in the lamellae.

CHRONOMETRIC DATING

Thirteen radiocarbon dates were obtained from 22It590 (Table 21). The samples, except one, were all from midden matrix because of direct associations between temporally sensitive artifacts and charcoal in feature context were lacking.

TABLE 21
Radiocarbon dates, 22It590.

Lab #/ Field Number	Block/ Level	C-14 (BP)	Uncorrected (Corrected) Calendar Age (BP)	Archaeo-magnetic Date	Material	Cultural Affiliation
DIC-2039/ 590-2507	5	5227±70	3777 (4460)		nutshell/ charcoal	Benton
DIC-2040/ 590-2058	6	5758±75	3540 (4210-4260)		nutshell/ charcoal	Benton
DIC-2042/ 590-2514	9	5778±75	3828 (4480)		nutshell/ charcoal	Middle Archaic
DIC-2043/ 590-2515	10	6056±70	4106 (4730-4840)		nutshell/ charcoal	Early Archaic
DIC-2044/ 590-2516	10	5881±100	3931 (4750)		nutshell/ charcoal	Early Archaic
DIC-2045/ 590-2517	10	6211±90	4261 (4990)		nutshell/ charcoal	Early Archaic
DIC-2036/ 590-2519	11	6345±175	4395 (5100)		nutshell/ charcoal	Early Archaic
DIC-2041/ 590-2524	Feature 34	6200±85	4250 (4980)		nutshell/ charcoal	Middle Archaic
DIC-2032/ 590-3501	9	6293±75	4343 (5050)		nutshell/ charcoal	Middle Archaic
DIC-2033/ 590-3502	9	6314±80	4364 (5060-5090)		nutshell/ charcoal	Early Archaic
DIC-2034/ 590-3503	10	6417±80	4467 (5180-5240)		nutshell/ charcoal	Early Archaic

TABLE 21
Radiocarbon dates, 22It590.

Lab #/ Field Number	Block/ Level	C-14 (BP)	Uncorrected (Corrected) Calendar Age (BP)	Archaeo-magnetic Date	Material	Cultural Affiliation
IC-2035/ 590-3504	10	6468±110	4518 (5240)		nutshell/ charcoal	Early Archaic
DIC-2046/ 590-4441	Test Pit 18	modern	modern		tree stump	

a = Corrections calculated based on MASCA curve (Ralph et al. 1973).

Six samples were from levels associated with the Early Archaic occupations. Unfortunately, all of these Early Archaic dates are considered to be too recent. The charcoal appears to have migrated down or to have been mixed with charcoal from above.

Two radiocarbon dates associated with the Benton component (5,777 B.P. and 5,227 B.P.) are consistent with other Benton dates from the Poplar and Walnut sites. One other date was obtained from the Benton zone, but the 3,828 B.P. date is too recent to accept.

One date of 6,200±55 B.P. was from a Middle Archaic pit originating just below the Benton zone. The date is consistent with the Sykes-White Springs Middle Archaic components dated at the other sites. The modern date obtained was not unanticipated despite the considerable depth (ca. 3 m or 9.9 ft) of this buried tree stump. The sample was extracted from Test Pit 18 on the extreme northwestern edge of the site in an attempt to date the Pleistocene ridge remnant in Stratigraphic Trench 2.

SUMMARY

The Ilex site composed of fluvial and colluvial deposits was located on the first terrace of Mackey's Creek valley. The terrace was surrounded by wetlands in the floodplain of Mackey's Creek approximately 6 km (3.7 mi) upstream from the confluence with Big Brown Creek which forms the Tombigbee River. The site apparently had an oval outline prior to being truncated on the north and west.

Recent disturbance by heavy machinery had destroyed a considerable portion of the site prior to testing in 1979 and excavation in 1981. At this time, it was ca. 60 m (196 ft) from Mackey's Creek. The site may have originally extended to the creek.

Investigations conducted at this site documented that it was occupied continually for the last 10,000 years. Despite removal of portions of the site, a good sample was recovered from the past occupations.

Archaic Stage: The oldest cultural material was contained in the Late Pleistocene/Early Holocene terrace remnant on the western portion of the site (Blocks G and H). Most of the Early Archaic and Middle Archaic artifacts were contained within Early Holocene fluvial sands deposited during intermittent periods of stream aggradation.

Early Archaic occupations at the Ilex site were identified by projectile point/knives that included Beaver Lake, Big Sandy, Dalton, Greenbriar, and Kirk stylistic markers. Cypress Creek artifacts also occurred in early stratigraphic contexts, but appeared to represent either very late Early Archaic occupations or a transition into the Middle Archaic. Stratigraphic and radiocarbon data from 22It539 likewise suggested that Cypress Creek point styles date somewhat more recently in time than those included in the Early Archaic complex.

Archaic projectile point/knives were recovered with greatest frequency from the Master Block excavation area in Levels 9-11 between 90 and 110 cm (2.9-3.6 ft) below the surface. Kirk, Greenbriar, and Dalton types were most frequent in the Early Archaic types. General blade morphology, retouching patterns, beveling, and serration indicated that they were multipurpose tools. Kirks, in particular, revealed consistent alternate edge beveling, indicative of resharpening while in the haft implying use as a cutting implement rather than projectile.

The stylistic characteristics of the projectile point/knives ranged from long, lanceolate forms, such as Beaver Lake and Greenbriar, to small, corner-notched Kirk forms. The morphological diversity present in this sample implied a significant temporal span (ca. 10,000-8,500 B.P.) for Early Archaic occupations.

Early Archaic assemblages included a wide range of implement forms, such as scrapers and drills, and bifacial reduction products and by-products. Scrapers were dominated by small, unifacial varieties (ca. 96% of scrapers recovered from 100-110 cm (3.3-3.6 ft) below the surface in Master Block), with well-defined "thumbnail" or "keeled-end" styles being common. Other tools, although not stylistically distinctive, included gravers, perforators, reamers, adzes, choppers, unifacial and bifacial knives, chisels, wedges, and a small number of ground stone items dominated by ground hematite and limonite and ground flakes. A single ground atlatl weight of greenstone was associated with Early Archaic levels in the Master Block.

Debitage conformed to the pattern of all site components and consisted of heated and unheated Camden chert. Fort Payne chert was well represented and dominated minority raw material types in Early Archaic samples.

Early Archaic features consisted exclusively of two pits probably used for refuse disposal or storage. Site use during the Early Archaic appears to have consisted of relatively short-term camps, but longer term base camp occupations possibly occurred. The diversity of implements and artifacts represented suggested base camp settlement(s), although the relatively low number of items in any category combined with the proposed span of Early Archaic occupations may have accounted for this occurrence.

Projectile point/knife styles associated with Middle Archaic occupations included Eva, Morrow Mountain, Sykes-White Springs, Vaughn, and Beachum. Eva, Sykes-White Springs, and Morrow Mountain specimens were most frequent. In general, the Middle Archaic specimens did not exhibit the patterns of use-wear or the degree of internal diversity noted in the Early Archaic. The typological variation present in the Middle Archaic, in conjunction with the stratigraphic contexts of these materials, implied an age-range from ca. 8,500-6,000 B.P. (ca. 6,500-4,000 B.C.). Multiple projectile point/knife types suggested intermittent occupation of the site throughout this period.

Apart from the projectile point/knives, there were few notable differences of the material assemblage from the preceding Early Archaic. Material densities appeared to increase slightly, although diversity in implement categories did not change much. Scraper forms generally lacked the stylization noted in the Early Archaic assemblage and drills-perforators increased in number during the Middle Archaic. Another difference was the increase in both number and diversity of the ground stone categories. The most obvious difference in Middle and Early Archaic occupations was the accumulation of organically stained cultural midden with charcoal flakes and increased organic residue. This was consistent with 22It539 and 22It576 and was perhaps a direct result of changes in subsistence/settlement patterns. Settlements of longer duration, and possibly of greater intensity, most likely produced these cultural middens. This pattern may be indicative of the establishment of base camps, rather than temporary camps, at this time throughout the UTV.

The Benton assemblage of the Middle Archaic components was characterized by the diversity of forms and uses represented in the projectile point/knives. The Benton projectile point/knife dominated the chipped stone assemblage and modification of these points into secondary implement forms (e.g., drills and scrapers) was extensive. A wide range of uses, therefore, was represented within the variant categories of Benton projectile point/knives (e.g., projectiles, knives, scrapers, multipurpose implements).

Significant differences also occurred in chipped stone and lithic raw material procurement. The focus of these changes was an increased use of Fort Payne chert in the manufacture of bifacial implements. Large biface blades of Fort Payne chert, not locally available, commonly were the starting points in the manufacture of Benton projectile point/knives. This technological shift is reflected in preform and biface blade categories and by changes in bifacial reduction strategies and an increase in the occurrence of Fort Payne chert.

Changes in other aspects of this assemblage consisted of an increase in numbers of items left behind in the midden and appeared to correspond to greater occupational activity and longer settlement of the site. The two dates, averaging 5,794 B.P., obtained in the Benton component at 22It590 are consistent with the dates and evidence of Benton components obtained from other sites investigated.

McIntire and Ledbetter/Pickwick projectile point/knives recovered from the site may represent a small Late Archaic component. Limited data and the extent of mixing within overlying ceramic-bearing components reduce the reliability of inferences drawn.

Post-Archaic Stage: The post-Archaic deposits at the Ilex site were marked by the abrupt appearance of ceramics. The number of ceramics recovered increased in the upper levels of the deposit, with the largest concentration occurring in the top 10 cm (3.9 cm).

Isolation of cultural strata within the ceramic-bearing deposits at this site was not possible. Ceramics spanning the period from middle Gulf Formational period (ca. 900-500 B.C.) to Mississippian stage (ca. A.D. 1,000-1,550) occupations were present at the Ilex site. The Gulf Formational and Middle Woodland ceramics were far more frequent than later cultures and may represent the major post-Archaic occupations of the Ilex site.

The intensity and/or duration of these late components, as indicated by the high density of material, appeared to be only slightly reduced from the Benton occupations. This evidence, combined with the strong midden development associated with ceramic-bearing occupations, suggests the persistence of the pattern of intermittent, semipermanent occupations.

EXCAVATIONS AT THE HICKORY SITE (22It621)

The Hickory site was located approximately 14 km (8.7 mi) north of Fulton, Ms in the Tombigbee River (Figure 1) floodplain 300 m (984 ft) from the valley wall. The site was a low ovoid knoll, 25 m (83 ft) by 38 m (124 ft), rising

60 cm (2.0 ft) above the surrounding floodplain (Figure 15). The upstream edge of this elevation had a steep and higher profile than the downstream end. The Hickory site was located in an especially low and wet portion of the floodplain. The area had many seep springs, flowing water, and swamps. There were several small tributaries and former tributaries in the near vicinity surrounding the site. This site was an "island" of sandy soil in the swampy floodplain. The landform appeared to have originated as a point or parallel bar deposit in the floodplain which grew in size through alluvial deposition. Prior to testing, the site was covered with an oak-hickory hardwood forest.

FIELD METHODS

The Hickory site was discovered during the 1979 testing project with the assistance of a local collector. The site had undergone extensive looting and had not been recorded by previous waterway surveys. Its proximity to similar sites, especially 22It539, made it practicable for the site to be tested in 1980 as part of Phase I of this project (Bense 1982). Testing consisted of two 4x4 m (13.2x13.2 ft) units placed in the center of the mound where there was the least disturbance (Figure 15). The high water table and rainy conditions forced the abandonment of one test unit (B) after 60 cm (23.4 in) and trenching around Unit A to reach sterile soil in one half of the unit.

Although the upper meter (3.3 ft) of black organic midden was disturbed, the yellow-brown zone beneath the midden appeared to be undisturbed and contained Early to Middle Archaic deposits. Excavations were conducted between November of 1981 and January of 1982 to investigate the Early Archaic component. Excavation focused on the highest, central portion of the site where the deeper deposits had occurred on other similar sites. The central sediments were least disturbed by cutting and filling episodes seen in Test Unit A. Between the testing and data recovery phases, this site was accidentally included in the clear-cutting of the floodplain for the waterway. However, since the intact deposits were probably preserved beneath the meter of midden, mitigation plans were not affected.

Significant technical and logistic problems were encountered in preparation of this site for excavation because of the low and swampy floodplain location. Further complications occurred because clear-cutting had obliterated grid landmarks. Site preparation was initiated by removing the mixed upper midden with a backhoe in the central area of the site. This allowed quick access to the cemented manganese stratum which was at the base of the organically stained midden which sealed the Archaic deposits. Approximately 75-85 cm (2.5-2.6 ft) was removed in an area approximately 18x25 m (59x82 ft) in size.

An area of about 250 sq m (820 sq ft) was then selected at the most central portion of the site for excavation. Around this central area a trench was excavated with the backhoe to provide a dry pedestal to be excavated (Figure 15). The trench was 1.5-2 m (4.9-6.6 ft) wide, 60 m (196.8 ft) in total extent and 2-3.5 m (2.6-11.5 ft) deep and enclosed a 22.5x11 m (73.8x36 ft) area. The depth of the trench and the unstable sandy sediments made it necessary to share, the entire length of the trench had to be shored and cross-braced with heavy lumber. Pumps were used to remove water from the trench, and the pedestaled block remained dry.

Three 4x4 m (13.2x13.2 ft) blocks (Blocks C, D, and E) were placed in the pedestal (Figure 15), and all were excavated to sparse cultural material. One 2x2 m (6.6x6.6 ft) unit was excavated in each block to sterile soils.

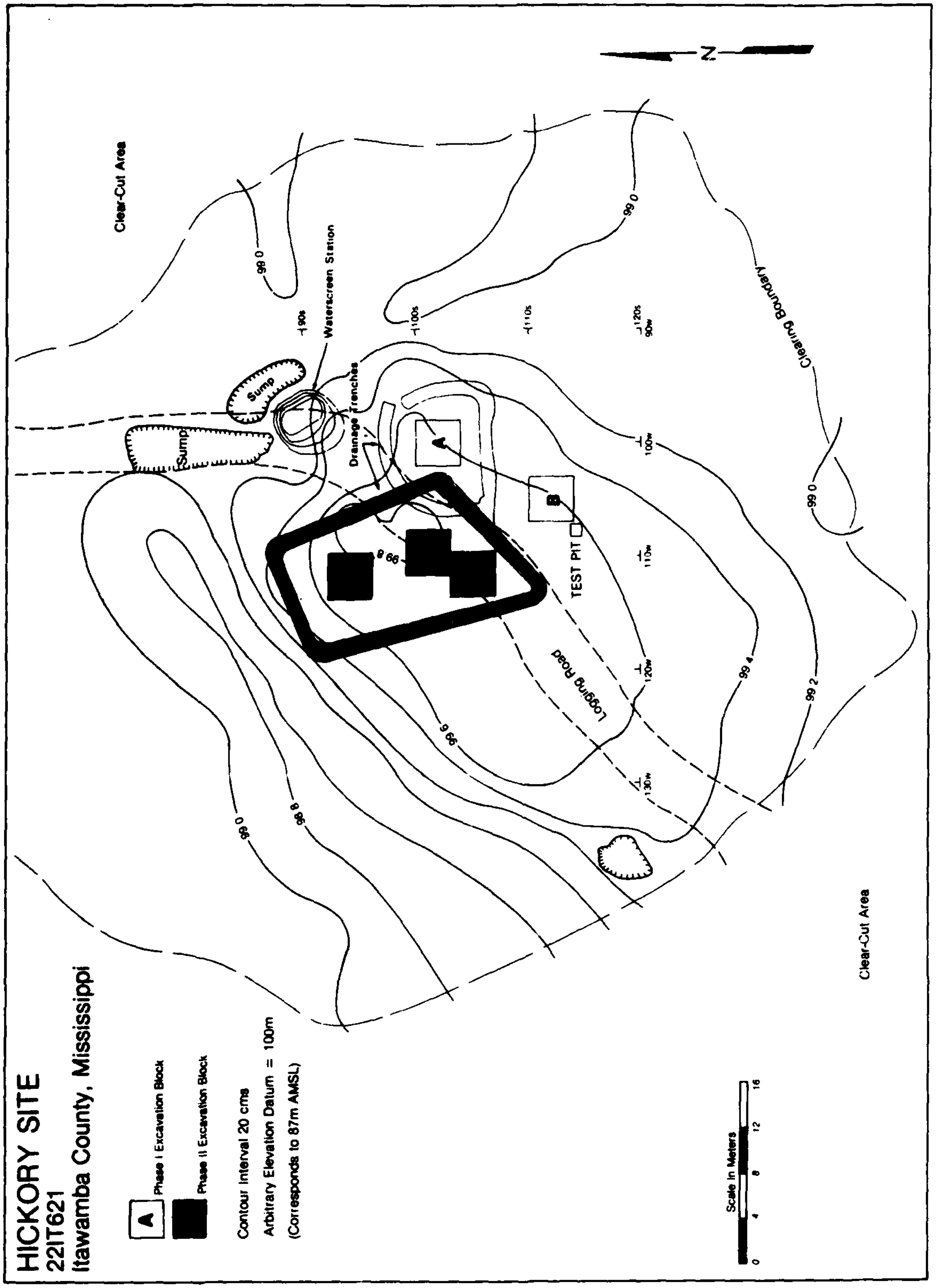


Figure 15 Topographic map and excavation plan, 22It621.

To address the possibility of post-depositional artifact movement, artifacts in the lower strata discovered were plotted and photographed in situ to record the orientation. A soil monolith or column that exhibited the total stratigraphic sequence of the lower strata was removed from the west wall of Block D.

The control block was expanded to 1x1 m (3.3x3.3 ft) and all soil was completely processed by flotation in an attempt to recover more botanical remains, from the Early Archaic deposits which previously had been scarce in all the sites investigated. This and all other soil was processed in the City of Fulton because of contaminated water at the site.

CULTURAL REMAINS

A total of 5,997 sherds were recovered from the Hickory site. All but 81 of these sherds were recovered during the testing phase in Blocks A and B. The removal of the dark organic midden from Blocks C, D, and E precluded the recovery of ceramics in them. In Blocks A and B, ceramics were found most frequently in the upper 50-60 cm (1.6-1.9 ft), but they were present in minor amounts to 90 cm (3.0 ft). The vertical distribution of temporally sensitive ceramic types indicates that the midden had been disturbed. Consistently, types with discrete chronological spans appeared together in the same level.

Looting apparently disturbed the integrity these deposits. However, the total ceramic assemblage exhibits several patterns. Late Woodland (38) and Mississippian (3) sherds were inconspicuous parts of the total (Table 22).

The assemblage is dominated by sand-tempered ceramics (81.5%), 70%, including 8.4% Alexander series ceramics, reflects a strong occupation during the Middle Woodland and Late Gulf Formational. Nine hundred and thirty-seven fiber-tempered sherds (15.6% of the total) also reflects a Middle Gulf Formational occupation of this site. This agrees well with the Middle Gulf Formational sites investigated in this project in nearby sites.

TABLE 22
Ceramic frequencies by temper, 22It621.

Temper Type	Frequency	Percentage
Shell	3	0.1
Grog	36	0.6
Bone	2	0.1
Limestone	133	2.2
Sand	4,886	81.5
Fiber	937	15.6
Total	5,997	

The 5,997 sherds recovered from Blocks A and B is surprisingly large, far exceeding the number found at any other site. Perhaps this indicates a Gulf Formational and Middle Woodland occupational intensity unknown at any other.

As in all other assemblages, the most frequent category of chipped stone implements were fragments of unidentifiable tools (480: 32.6%) which are grouped in the "Other Uniface and Biface Tools" in Table 23. The high number of projectile point/knives (32.4%) reflects significant agreement with other assemblages. Bifaces were the next most frequent category, followed closely by scrapers, and drills and perforators.

TABLE 23
Chipped stone tool frequencies by type, 22It621.

Type	Frequency	Percentage
Projectile Point/Knives		
Beachum	1	
Benton Short Stemmed	8	
Big Sandy Side Notched	1	
Bradley Spike	1	
Cotaco Creek	3	
Cumberland	1	
Cypress Creek	2	
Eva	6	
Flint Creek	22	
Gary	2	
Greenbriar	2	
Kirk	14	
Ledbetter/Pickwick	7	
Little Bear Creek	59	
McIntire	2	
Mississippian-Woodland Triangular	1	
Morrow Mountain	12	
Quad	1	
Residual Stemmed	29	
Residual Triangular	2	
Sykes-White Springs	3	
Tombigbee Stemmed	1	
Vaughn	1	
Wade	1	
Unidentified projectile/point/knife	1	
Distal fragment	119	
Medial fragment	80	
Proximal fragment	87	
Lateral fragment	7	
Subtotal	476	32.4%
Scrapers	104	7.1
Drills, Perforators, etc.	105	7.1
Bifaces	152	10.3
Other Uniface and Biface Tools	524	35.6
Cores	44	3.0
Preforms	65	4.4
Total	1,470	

A total of 2,261 utilized flakes were recovered from the site. Interestingly, the 0.5 inch (1.3 cm) and 0.25 inch (0.64 cm) size flakes of utilized flakes occurred in approximately the same frequencies. In contrast, the non-utilized flake pattern apparently reflected a preference for larger flakes. Of the 48,576 non-utilized flakes or debitage recovered from the site 86.6% were 0.25 inch (0.64 cm) (Table 24), only 12.9% were 0.5 inch (1.3 cm), and 0.3% were over one inch (2.54 cm) in size. As in other midden mound assemblages, this pattern indicates reduction of cobbles to biface tools. The debitage raw material was dominated by Camden chert, both heated (78%) and unheated (13.9%), with minority raw materials making up the remaining 8.1% of the debitage.

TABLE 24
Size-grade frequencies of debitage, 22It621.

Category	Frequency	Percentage
1.0 inch	194	0.3
0.5 inch	6,272	12.9
0.25 inch	42,091	86.6
Non-utilized flake - Prismatic	9	0.1
Other	10	0.2
Total	48,576	

A total of 1,470 chipped stone tools were recovered at the Hickory site. A total of 71 identifiable ground stone and 120 unidentifiable fragments of ground stone tools were recovered from the Hickory site (Table 25). Hammerstones were the most frequent tool type (21), and they often were combined with mullers or anvilstones. The next most frequent tools were anvilstones (17), and these were often also used as hammerstone or abraders. One grooved axe was recovered along with a few ornamental artifacts. The ground limonite and hematite also had been provided for ornamental pigment extraction. The main uses of ground stone tools, however, were hammering, pounding, and abrading.

The ratio of tools to debitage in the Hickory site lithic assemblage is 1:35, much higher than at the previous sites investigated. The flake size ratio is 1:32:216 and reflects production of chipped stone tools from cobbles at the site.

TABLE 25
Ground stone tool frequencies by type, 22It621.

Category	Frequency	Percentage
Abrader	3	1.6
Anvilstone	2	1.0
Anvilstone-Hammerstone	3	1.6
Pitted Anvilstone	10	5.2
Pitted Anvilstone-Abrader	2	1.0
Bead	1	0.5
Bead Preform	1	0.5
Discoidal	1	0.5
Gorget	1	0.5
Grooved Axe	1	0.5
Hammerstone	21	11.0
Mortar	1	0.5
Muller	4	2.1
Muller-Hammerstone	1	0.5
Muller-Pitted Hammerstone	2	1.0
Ground Hematite	4	2.1
Ground Limonite	2	1.0
Ground Stone Flakes	11	5.8
Unidentified Fragment	120	62.8
Total	191	

A total of 126.0 kg of introduced rock was recovered in the investigations. As at the other sites investigated, this was dominated (89%) by ferruginous sandstone, locally available in the nearby uplands. Only eight grams of faunal remains were recovered from the site. It was calcined and too fragmentary for taxonomic or element identification.

FEATURES

Only four cultural features were encountered at the Hickory site, including three basin-shaped pits and one lithic debitage cluster. One Kirk stemmed projectile point was contained in a pit, indicating an Early Archaic association. The others contained no diagnostic artifacts, but stratigraphic position suggested that they were Middle Archaic (Sykes-White Springs/Benton).

All these features were first encountered in Stratum IIB. All features contained a relatively large amount of unmodified flaking debris and the upper portions of the features produced most of the materials.

It is difficult to discern their primary function. These features may have been associated with stone tool manufacturing or utilized as refuse pits. It is speculated that Feature 1 was a pile of lithic debitage. Of 141 flakes recovered, only two were utilized (0.25 in or .64 cm flakes). These flakes were in a pile which had a poorly defined boundary. The three basin-shaped pits contained a moderate amount of botanical remains in addition to the lithic materials. The density of botanical remains in the feature fill was much higher than that in the general midden. Unmodified introduced rocks were also present in each feature. Shapes and contents of these features indicate use as refuse or storage pits.

STRATIGRAPHY

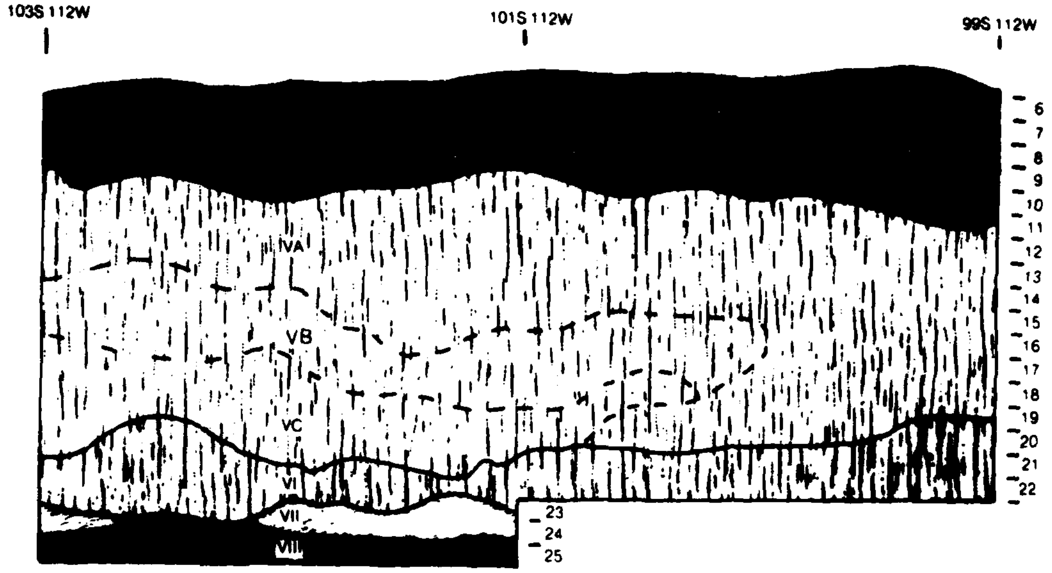
The Hickory site was formed through alluvial deposition of sandy loam during episodic flooding. The profile was characterized generally by an upper dark organically stained midden resting uncomformably on a truncated yellow-brown paleosol with well-developed structure on a blue-gray gleyed clay deposit. Within these two general zones, eight strata were identified (Figures 16 and 17). The dark organically stained midden was approximately 1 m (3.3 ft) thick. The lower half of the midden was hard and composed of cemented manganese concretions. This cemented zone was probably caused by almost continual water table saturation of the profile. This manganese concretion zone was unique to this site.

The contact between the paleosol and the overlying midden was abrupt, and often had an intervening lens-like deposits of coarse sand (Figure 17). These sandy pockets were scattered throughout the edges of the paleosol, reflecting a turbulent environment at one time in the site area. The sand deposits on the top of the paleosol likely resulted from the erosional episode that removed the A and part of the B horizon at this and other sites in this part of the floodplain. The paleosol at this site was similar to other exposures, i.e. yellow-brown color, well-developed prismatic structure with post-development polygonal cracking throughout. The sand pockets were more frequent around the edges of the site. The central core, or epicenter, of the landform was still intact.

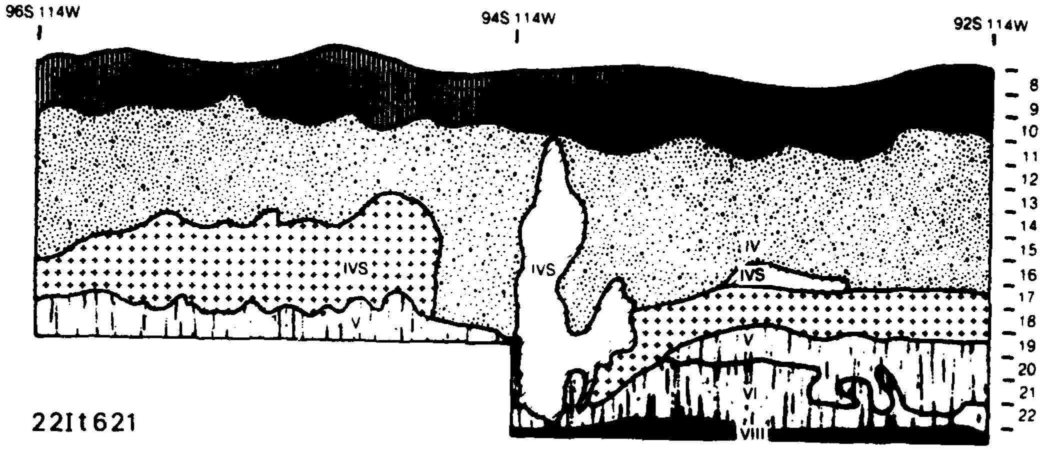
At this site, excavations continued to the base of the paleosol, exposing the bright orange C horizon beneath the well-developed B. The oxidation of the C horizon was likely due to induration of iron-rich minerals in the perched water table. Excavations continued into this zone (VIII) confirmed that this was the Pleistocene valley floor.

Site profiles indicate that the initial process of site formation involved the deposition of yellow-brown loam in the center directly upon a submerged clay zone. These deposits built the site to the current configuration. The paleosol developed, but portions around the periphery were removed and replaced subsequently by sands. The upper midden zone then accumulated above

BLOCK D WEST PROFILE



BLOCK E WEST PROFILE



IIIB	Very dark gray (10 yr 3/2) sand mottled with light brownish gray (10 yr 6/2) and black (10 yr 2/1) manganese zone
IV	Dark brown (7 5 YR 3/4) sandy loam mottled with gray (10 YR 5/1)
IVS	Gray to yellowish brown (10 YR 7/2. 10 YR 5/6) massive sand
VA	Paleosol, gray sandy loam matrix (10 YR 7/2) with reddish yellow reticulate mottling
VB	Same as A, more sandy
VC	same as A, very sandy
VI	Paleosol, strong brown (7 5 YR 5/8) sandy loam mottled with gray (10 YR 7/2) (appears bright orange in contrast to other strata)
VII	Reddish yellow (7 5 YR 5/8)
VIII	Dark gray clay (5 YR 4/1) with gray sandy loam pockets
2	Arbitrary 10cm excavation level

Figure 16 Stratigraphic profiles, 22It621.

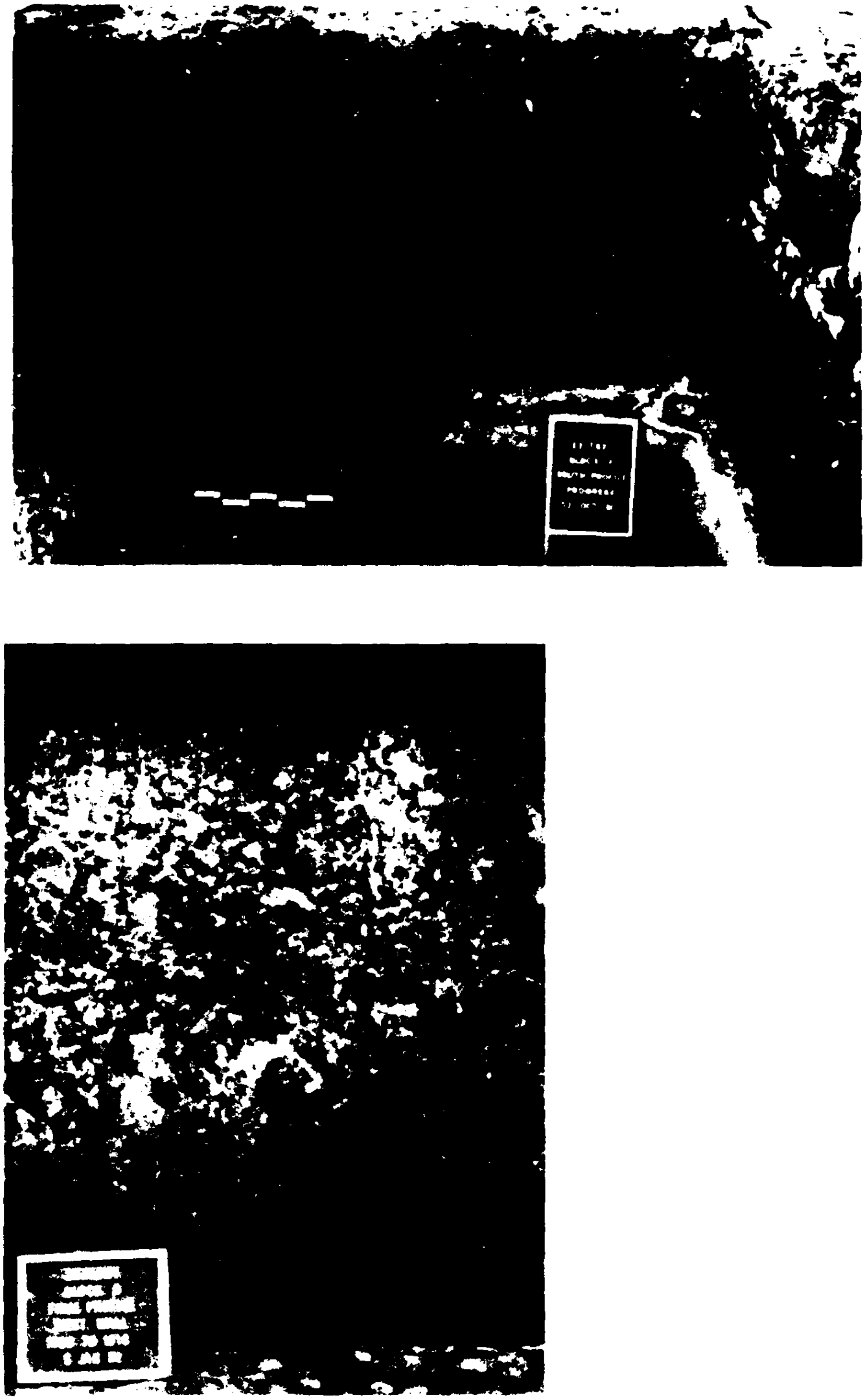


Figure 17 Stratigraphy of Blocks D and E, 22It621.

this surface and the manganese and ferrous concretions were formed in a water-saturated environment.

SUMMARY

The Hickory site was a natural landform formed by alluvial deposition in the floodplain of the Tombigbee River. The local environment of the site appears to have been and continues to be, wet and poorly drained. The site strata exhibited alteration through time associated with this wet environment, cutting and filling of the strata, oxidation, and the formation of mineral concretions. The landform was occupied continually from the earliest occupation of the valley during the Late Paleo-Indian through the Mississippian stage.

Late Paleo-Indian Stage: Late Paleo-Indian occupation at the site is postulated based on the recovery of two Paleo-Indian projectile point/knives: a Quad and Cumberland. The Quad was recovered from Strata II/IIIA during testing and appeared to be out of context. The Cumberland was recovered from the backfill removed by a backhoe when excavating the de-watering trench. It may have been *in situ*; however, the excavations of Blocks C, D, and E went below the base level of the trench and no intact component was encountered.

Archaic Stage: The recovery of 19 diagnostic projectile point/knives (12 Kirk Corner- Notched, two Cypress Creek, one Greenbriar, and one Big Sandy) documented the Early Archaic occupation of this site. Five specimens (four Kirk Corner-Notched and one Greenbriar) from Stratum V were undoubtedly *in situ*. Seven Early Archaic projectile point/knives were in Strata IIIB - IV (four Kirk Corner-Notched, two Cypress Creek, and one Big Sandy Side-Notched). The other diagnostic Early Archaic projectile point/knives were from the upper strata and were apparently out of context mixed with the Late Archaic and Gulf Formational material.

Three of the Kirk Corner-Notched points, all from the *in situ* Early Archaic deposit, were recycled with broken distal ends retouched for use as scrapers. A moderate number of chipped stone tools (8.8 per cubic meter) and unmodified flaking debris (131.2 per cubic meter) were present in the deposit (Stratum V). The chipped stone tools included a dozen additional scrapers or scraper fragments and 215 utilized flakes. This high proportion of scrapers perhaps indicates that specific activities, e.g., hide and/or wood working, took place at this site during the Early Archaic period. The recycling of projectile points and the proportion of utilized flakes also indicates efforts to maximize lithic material. Even small flakes (0.25 in or .64 cm in size) were extensively utilized. Camden chert (both heated and unheated) was the predominant raw material, although Fort Payne chert and conglomerate were used to a limited extent. This site was probably used during the Early Archaic as a camping station, possibly for hunting and hide working.

A Middle Archaic occupation was indicated by 12 diagnostic projectile points. Of these, eight (four Morrow Mountain and four Eva) were recovered from the dark, cemented zone (Strata III-IV), while the other four specimens (three Sykes-White Springs and one Morrow Mountain) were recovered from Stratum II, indicating the association of stratigraphic zones and cultural deposits at this site.

The Middle Archaic assemblage in Stratum IIIB consists of six projectile point/knives (four Eva and two Morrow Mountain), 659 chipped stone tools, including 440 utilized flakes, and 6,604 non-utilized flakes. In addition, seven ceramic sherds were recovered. The transition from the Early to Middle Archaic occupation at the Hickory site appears to have been gradual, and Eva, Morrow Mountain, and Cypress Creek projectile point/knives appeared between the main assemblages. During the Middle Archaic the site use apparently changed. This change was signalled by the increase in the amount of chipped stone tools and flaking debris.

Although a large amount of cultural remains was recovered from later site occupations, the stratigraphic boundaries and assemblages can only be broadly defined because of extensive mixing of the deposits from vandalism. In Blocks A and B the upper midden zone (Strata I - III) was screened and indicated the presence of a late Middle Archaic Sykes-White Springs/Benton deposit between 50-70 cm (1.6-2.3 ft) below the surface in Stratum IIIA just above the cemented midden zone. This component was identified by Benton (8) and Sykes-White Springs (3) projectile point/knives. This occupation appears to have been less intense than at the Walnut and Poplar sites, which are within 2-8 km (3-13 mi) of this site.

A Late Archaic component was identified on the basis of 59 Little Bear Creek and 22 Flint Creek projectile point/knives. Most were concentrated in the upper midden zone. However, this mixed zone also contained thousands of sherds. The presence of a Middle Gulf Formational component was well supported by the presence of almost 1,000 Wheeler series fiber-tempered ceramics.

Alexander ceramics were also recovered from the Hickory site and document a Gulf Formational occupation similar in frequency of sherds to the other sites investigated.

Both Woodland, Miller I, and Miller II Middle Woodland occupations occurred at the Hickory site as indicated by the presence of diagnostic ceramics.

The Late Woodland occupation was poorly represented at this site as seen in the very low amount (0.8%) of shell, shell and grog, bone, and grog-tempered sherds, this points to little use of this site during this period.

A Mississippian component was not documented and the site appears to have been essentially abandoned after the Middle Woodland period ca. A.D. 500.

In summary, cultural materials from the Hickory site (22It621) indicate the slight possibility of a Paleo-Indian occupation. The site was perhaps intermittently utilized as a camping station during the Early and Middle Archaic periods for exploiting the natural resources of the surrounding floodplain. The range of tools retrieved from the Early and Middle Archaic strata generally indicated a series of limited activities involving procurement, processing, and manufacturing. An extensive occupation of the site was indicated by the abundance of cultural remains of the succeeding Late Archaic, Gulf Formational, and Middle Woodland components.

EXCAVATIONS AT THE BEECH AND OAK SITES (22It623 and 22It624)

The Beech and Oak sites (22It623 and 22It624) were situated on adjacent levee remnants of the floodplain of the Tombigbee River 8 km (13 mi) north of Fulton, Ms. The two sites are discussed together, since the geomorphological and archaeological evidence indicates they were probably a single entity, when occupied or if not, the two areas were occupied at the same time.

The sites were approximately 1.8 km (1.1 mi) east of the current river channel and 250 m (820 ft) west of the valley wall. The sites occupied linear, ovoid knolls that rise 80 cm (2.6 ft) above the surrounding floodplain oriented north-northeast/south-southeast (Figure 18). Each site area had a level surface. The Beech was larger, 68x30 m (233x98 ft), while the surface of the Oak site was approximately 48x30 m (157x98 ft). The sites were separated by a small, tributary stream which has bisected the landform and flowed west to east into the abandoned channel segment which parallels these levee remnants. The landforms rose abruptly along the eastern sides and graded gently into the floodplain on the west. The areas surrounding the site were wetlands. The abandoned channel segment to the east with a paralleling swamp and a flowing stream was ca. 75-100 m (246-328 ft) to the west. Both sites were islands of well-drained sandy loam surrounded by wet silty and clayey sediments. Both supported a mature floodplain hardwood forest of oak, hickory, and beech.

FIELD METHODS

The sites were first located during survey in 1979 (Bense 1983b) and recommended for testing to determine the nature, integrity, and significance of the cultural components. This testing was conducted in Phase I of this project. Testing at each site included a hand-excavated 4x4 m (13.2x13.2 ft) unit near the center of each site and one stratigraphic trench (Figure 18).

Testing results indicated multi-component sites, while the upper 50 cm (1.6 ft) was mixed it appeared to contain an intact Late Archaic component with well-defined features at the base of this midden. Since this time period was not well represented in the sample from the waterway in the Upper Tombigbee Valley. The component was recommended for data recovery. In addition, the location of the sites on the levee remnant was unusual which had not previously been investigated.

Excavations at the Beech and Oak sites were carried out between September and November of 1981. A backhoe removed the mixed upper 50 cm (1.6 ft) of midden in several areas of each site to reveal the top of the Late Archaic deposits. Each of these backhoe-stripped areas were then shovel shaved to locate features. Three 4x4 m (13.2x13.2 ft) blocks were then aligned to include the greatest number of exposed features (Figure 18).

At the Beech site, Block B was located adjoining Block A to the east to expose the remaining portion of a feature, which appeared to be a stratified pit extending into the east wall. Block C was located in the north part of the site, and Block D was situated in the southern part of the site. Several features outside the blocks were also investigated.

At the Oak site, one large area including most of the highest level surface of this smaller site was exposed by the backhoe. Shovel skimming indicated that most features were concentrated in the center, or highest part of the site, and the three units were placed in these areas. As at the Beech site, individual features located outside the blocks were also investigated.

CULTURAL REMAINS

A total of 3,674 sherds were recovered from the Beech and Oak sites: 1,865 sherds from 22It623 and 1,809 sherds from 22It624 (Table 26). The ceramics were present primarily in the upper 30 cm (10 in) of the midden, although they were recovered in smaller numbers to 50 cm (1.6 ft). Although the vertical position of the temporally sensitive temper types indicated the midden had lost its integrity, information could still be drawn from the relative amounts of temper types present at these sites. The number of sherds recovered from each site was almost the same indicating equal intensity of ceramic producing

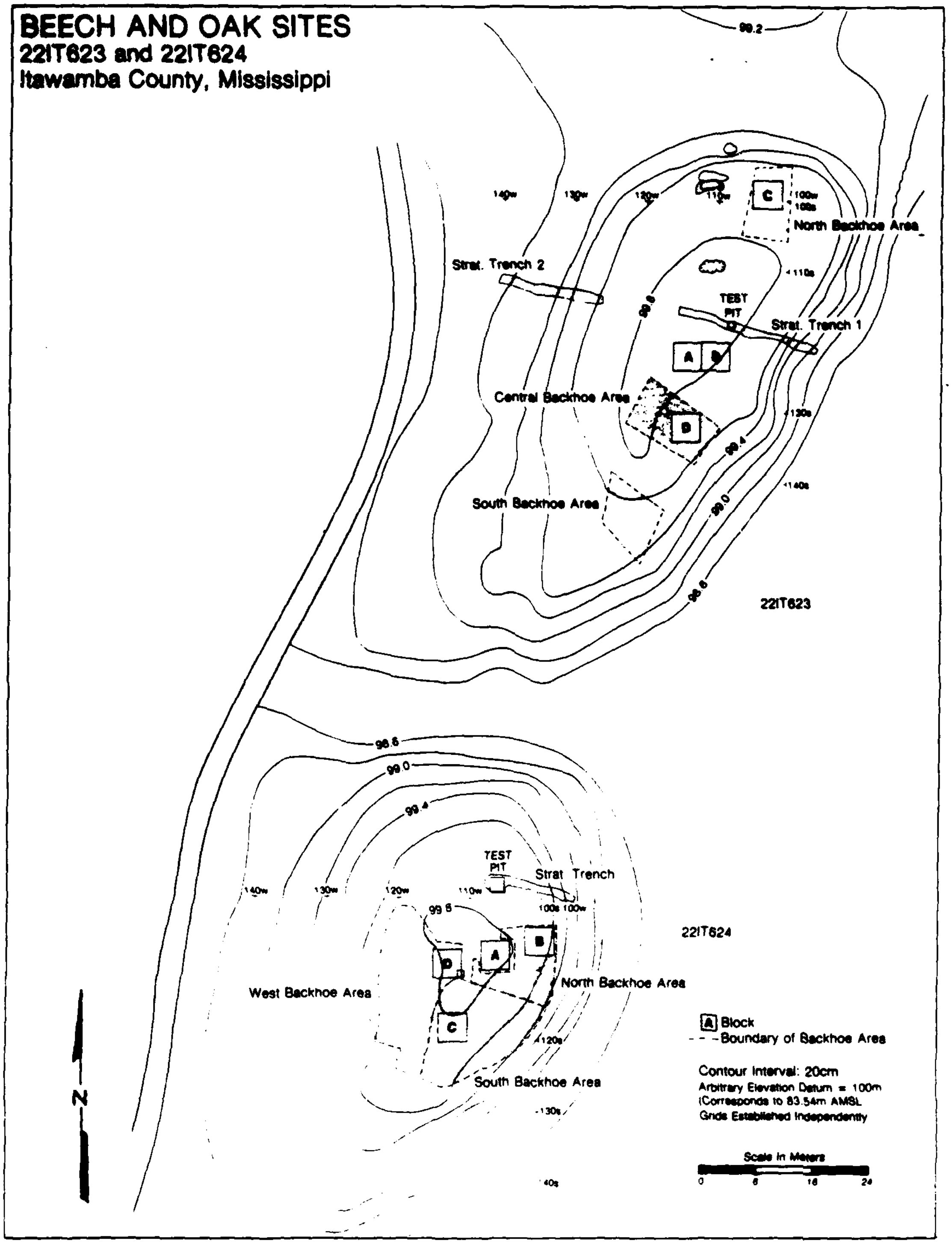


Figure 18 Topographic map and excavation plan, 22It623 and 22It624.

occupations. The temper types of the Late Woodland and Mississippian (shell, grog, and bone) were found infrequently, comprising only 12.8% of the ceramics. The Middle Woodland temper types of limestone and sand were the most dominant, 8.1% and 67.1%, respectively. Of the sand-tempered ceramics, only 75 (2.0%) were of the Alexander series. Fiber-tempered ceramics from the middle Gulf Formational were 12.1% of the sample and indicated occupation of the site during this period.

TABLE 26
Ceramic frequencies by temper, 22It623 and 22It624.

Temper	Frequency			Percentage
	22It623	22It624	Total	
Shell	6	16	22	0.6
Grog	231	195	426	11.6
Bone	13	9	22	0.6
Limestone	217	78	295	8.1
Sand	1,231	1,235	2,466	67.1
Fiber	167	276	443	12.1
Total	1,865	1,809	3,674	

A total of 2,532 chipped stone tools were recovered from the two sites: 973 specimens from 22It623 and 1,286 from 22It624 (Table 27). The largest category of specimens was fragments of unidentifiable chipped stone tools (893 or 35.2%). These were grouped with "Other Uniface and Biface Tools" and account for all but 88 of those specimens. The most frequent identifiable tool type was projectile point/knives which made up 30.2% of the total sample and almost half (46.7%) of the identifiable tools. At the Oak site 67% of the tools recovered were projectile point/knives. Bifaces, scrapers, and drills were next in frequency, 10.8%, 9.3%, and 7.6%, respectively. The low number of cores and preforms was consistent with other assemblages in the floodplain.

TABLE 27
Chipped stone tool frequencies by type, 22It623 and 22It624.

Type	Category	22It623	22It624	Total	Percentage
Projectile Point/Knives					
	Beachum		6	6	
	Benton	12	13	25	
	Big Sandy Side-Notched	2		2	
	Bradley Spike	1		1	
	Cotaco Creek		16	16	
	Cypress Creek	2		2	
	Eva		1	1	
	Flint Creek	7	14	21	
	Gary	2		2	
	Greenbriar	1		1	
	Kirk Corner Notched	2	1	3	
	Ledbetter/Pickwick	3	6	9	
	Little Bear Creek	16	37	53	
	McIntire	6	18	24	
	Mississippian-Woodland Triangular	13	18	31	

TABLE 27
Chipped stone tool frequencies by type, 22It623 and 22It624 (continued).

Type	Category	22It623	22It624	Total	Percentage
	Morrow Mountain	4	7	12	
	Mud Creek		2	2	
	Residual Stemmed	14	31	45	
	Residual Triangular	1		1	
	Small Unfinished Triangular		2	2	
	Swan Lake	1		1	
	Sykes-White Springs	3	2	5	
	Tombigbee Stemmed		2	2	
	Vaughn	1	1	2	
	Wade	1	5	6	
	Distal fragment	51	100	151	
	Medial fragment	32	78	110	
	Proximal fragment	50	95	145	
	Lateral fragment	29	51	80	
	Turkey Tail	1		1	
	Unidentified		4	4	
	Subtotal	253	512	765	30.2
Bifaces		120	153	273	10.8
Scrapers		135	100	235	9.3
Drills, Perforators, etc.		75	117	192	7.6
Other Uniface and Biface Tools		473	508	981	38.7
Cores		18	20	30	1.2
Preforms		19	29	48	1.9
Total		1,093	1,439	2,532	

A total of 2,474 utilized flakes were recovered from these sites. They were fairly evenly distributed, with 56.5% from Oak and 43.5% for the Beech site. As in other assemblages, the lowest flake frequency was greater than one inch (2.54 cm) (1.0%) with 0.5 inch (1.27 cm) following at 40.6% and 0.25 inch (0.64 cm) at 52.5%.

Altogether 42,251 pieces of unmodified debitage were recovered during the excavations - 17,998 from 22It623 and 24,253 from 22It624 (Table 28). The pattern of debitage size grades was clear and reflected the same dominance as 0.25 inch flakes (86.6%). Larger flakes were decidedly less frequent (0.50 inch = 12.8% and ¶ 0.5 inch = 0.4%).

TABLE 28
Size-grade frequencies of debitage, 22It623 and 22It624.

Category	22It623	22It624	Total	Percentage
1.0 inch	22	95	167	0.4
0.5 inch	2,409	3,004	5,413	12.8
0.25 inch	15,509	21,149	36,658	86.8
Non-utilized flake Prismatic	5	2	7	0.1
Non-utilized flake Other	3	3	6	0.1
Total	17,998	24,253	42,251	

The relative proportion of chipped stone tools to debitage is 1:17 somewhat lower than other sites. The flake size proportion is 1:32:220, reflecting the production of tools at the site, although in a lower proportion than others investigated. A total of 558 ground stone specimens were recovered: 170 from 22It623 and 388 from 22It624 (Table 29). Most of the identifiable ground stone tools were for pounding and grinding. Anvilstones (7.5%) were often combined with mortars and mullers. Mullers (3.6%) were also combined with mortars and hammerstones, as well as anvilstones. Hammerstones (3.8%) and pitted anvilstones were the most frequent single tool type. Ground hematite and limonite (15.8%), beads and bead preforms, and drill cores (2.3%) reflected interest in personal adornment. The sandstone sherd was unusual in these floodplain assemblages.

TABLE 29

Ground stone tool frequences by type, 22It623 and 22It624.

Category	22It623	22It624	Total	Percentage
Abrader	7	4	11	2.0
Pitted Anvilstone	11	11	22	3.9
Atlatl Weight		5	5	0.9
Awl	4	3	7	1.2
Bead	4		4	0.7
Bead Preform	2	4	6	1.1
Celt	1		1	0.2
Drill Core		3	3	0.5
Hammerstone	11	10	21	3.8
Mortar	4	1	5	0.9
Mortar-Pitted Anvilstone	6	4	10	1.8
Muller	4	5	9	1.6
Muller-Pitted Anvilstone	6	4	10	1.8
Muller-Hammerstone	1		1	0.2
Grooved Abrader-Hammerstone	2		2	0.4
Sandstone Sherd		1	1	0.2
Sandstone Concretion		1	1	0.2
Ground Hematite	20	39	59	10.6
Ground Limonite	5	24	29	5.2
Other-Ground Flakes	6	17	23	4.1
Unidentifiable fragment	82	255	337	60.4
Total	87	205	558	

Only six grams of faunal remains were recovered, one gram from 22It623 and five grams from 22It624. All were calcined and too fragmentary for taxonomic and element identification.

A modern tobacco pipe was recovered 85 cm (2.8 ft) below the surface in Block C, 22It623. The plastic imitation corncob pipe still had tobacco in it. It was probably brought below the surface by a burrowing animal, since no pit was associated with it.

FEATURES

Fifty-five cultural features were encountered at the Beech and Oak sites. These included:

35 pits
14 probable postmolds
4 artifact clusters
1 fired area
1 bone cluster

The features were fairly evenly distributed between sites with 30 (56%) at Beech and 23 (44%) at Oak. Of the 35 pits encountered, the cultural affiliation of 12 was determinable: one possible Early Archaic, one Middle Archaic, one Middle or Late Archaic, four Late Archaic, two Wheeler, and three Woodland. The other 23 pits either had no diagnostic material or were too mixed to identify.

The pits at the Beech and Oak sites exhibited some differences from other sites investigated in this project. Four compound pits, actually pit "complexes" with several episodes of filling, deepening, or widening, were unique to the Beech and Oak sites. One of these features (Feature 1, Oak site) was apparently a natural depression, which was filled during several sequential Archaic occupations. No particular significance could be attributed to these pit forms.

A high number of post molds were recorded at these sites (14), which is unusual in this project. Although no pattern was seen in the distribution, three were present in the north half of Block D at the Beech site. These post molds averaged approximately 25 cm (9.8 in) wide and 35 cm (1.1 ft) deep.

Three complex clusters were also encountered. All located in Blocks A and B at the Beech site. One consisted of only ground stone tools (hammerstone and muller); one consisted of only chipped stone tools and sandstone fragments; and one was a cache of ceremonially broken bifaces. This feature consisted of 11 finely made and purposefully broken blades of Fort Payne chert, including a Turkey Tail and a double side-notched point. They were in a circular pile associated with a flat piece of ochre. Although this association was unique to the Upper Tombigbee Valley sites thus far investigated, comparable associations have been recovered in the Middle Tennessee Valley.

One fired area at the Oak site was identified. It was a cluster of burned sandstone, hematite, charcoal, and ash. No prepared clay hearths or fired clay aggregates were encountered at either site.

The bone cluster was a small concentration of mammal bones in Block A of the Beech site. Its cultural affiliation was not determined.

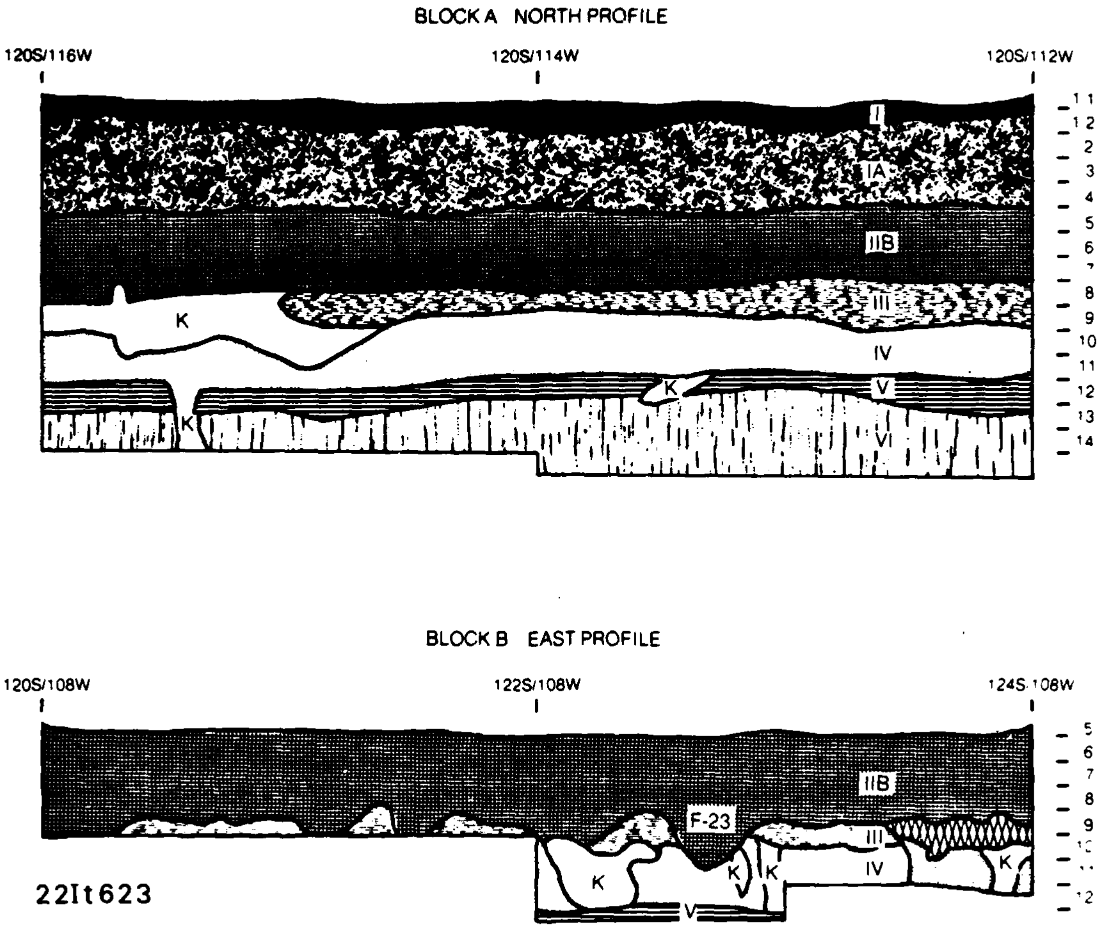
STRATIGRAPHY

The Beech and Oak sites were formed by alluvially deposited strata which were subsequently altered by natural and cultural processes. The overbank deposits were thicker and coarser on the east sides of both sites, and were thicker overall at the Beech site. Sediments were finer and thinner on the west and south of the landform, and it was assumed that the channel segment adjacent to the east of the levee fragments likely contained flowing water (probably the Tombigbee) during the formation processes and occupation.

The Beech and Oak sites were composed of three major stratigraphic zones: an upper, thick (50 cm: 1.6 ft), dark midden zone which overlaid a 90 cm (2.9 ft) deposit of sandy layers, which were only slightly organically stained (Figures 19 and 20) These sandy alluvial deposits rested uncomformably on the yellow-brown paleosol which had been truncated removing the original A and part of the B horizon.

CHRONOMETRIC DATING

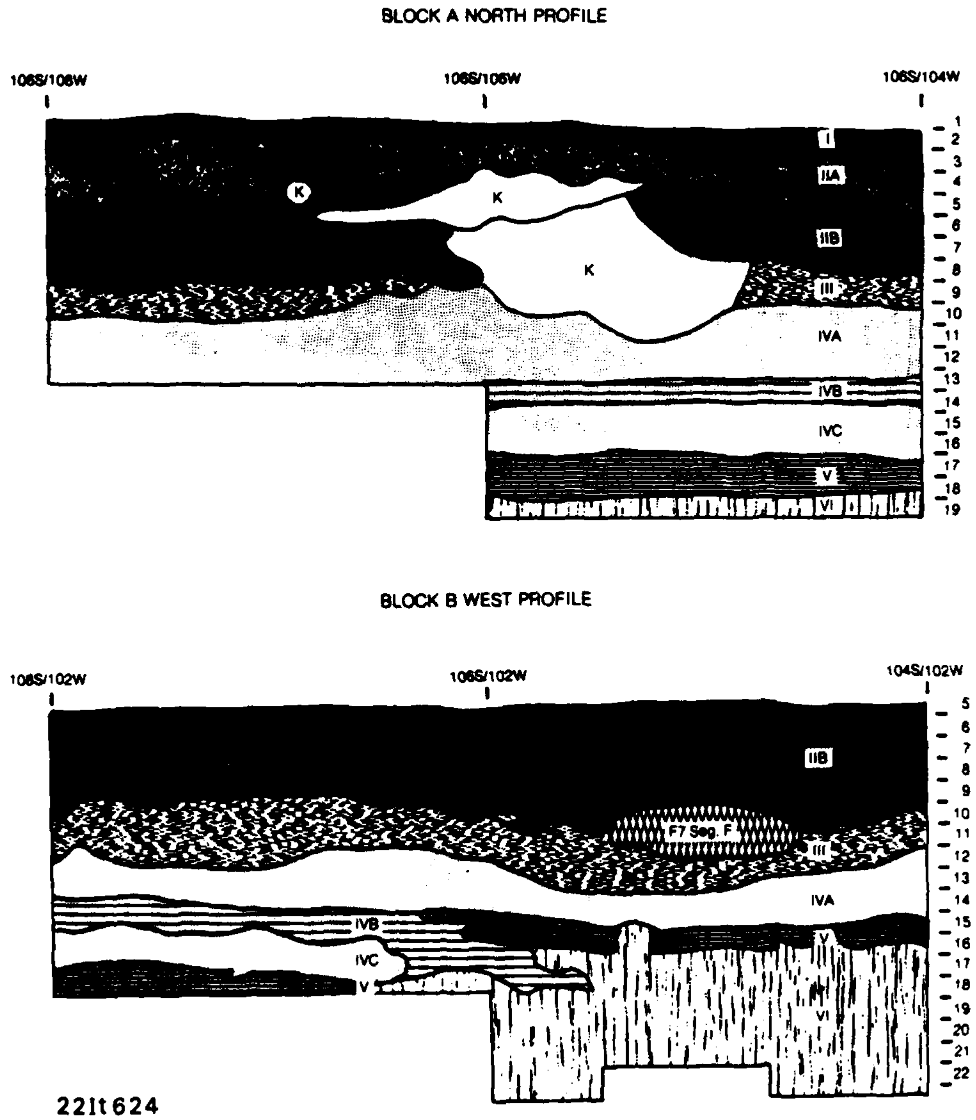
Seven radiocarbon dates were obtained from these sites; two from the Beech and five from the Oak (Table 30). All samples were from pit features in



- I Humus (topsoil) zone dark reddish brown (5 YR 2.5/2) sandy loam
- IIA Midden zone: dark reddish brown (5 YR 3/2) to dark brown (7.5YR3/4) sandy loam
- IIB Midden zone. dark reddish brown (5 YR 3/4) to very dark brown (10 YR 3/2) sandy loam
- III Transition zone: reddish brown (5 YR 4/3) to brown (7.5 YR 4/4) loamy sand with some light yellow (10 YR 6/4) and light gray (10 YR 7/1) mottling
- IV Fluvial zone: dark yellowish brown (10 YR 5/8) to very pale brown (10 YR 7/4) loamy sand with some lighter (10 YR 7/1, 8/4) mottling
- V Illuvial zone. dark yellowish brown (10 YR 4/4) to strong brown (7.5 YR 4/6) sandy loam
- VI. Paleosol. yellowish brown (10 YR 5/8) sandy loam matrix mottled and streaked with yellow (10 YR 7/6 2.5 Y 7/4), brown (7.5 YR 5/6) and light gray (5 Y 7/1) sandy loam and some clay

K Krotovina. non-cultural disturbance
2 Arbitrary excavation level
F Feature

Figure 19 Stratigraphy of Blocks A and B, 22It623.



22It624

I	Humus (topsoil) zone: dark reddish brown (5 YR 2.5/2) sandy loam.
IIA	Midden zone: dark reddish brown (5 YR 3/2) to dark brown (7.5 YR 3/4) sandy loam.
IIB	Midden zone: dark reddish brown (5 YR 3/4) to very dark brown (10 YR 3/2) sandy loam
III	Transition zone: reddish brown (5 YR 4/3) to brown (7.5 YR 4/4) loamy sand, with some light yellow (10 YR 6/4) and light gray (10 YR 7/1) mottling.
IV A, IV C	Fluvial deposits: yellowish brown (10 YR 5/8) very pale brown (10 YR 7/4) loamy sand, with some lighter (10 YR 7/1, 8/4) mottling.
IVB	Weak illuvial zone: yellowish brown (10 YR 5/4) to dark brown (7.5 YR 4/4) sandy loam
V	Illuvial zone: dark yellowish brown (10 YR 4/4) to strong brown (7.5 YR 4/6) sandy loam
VI	Paleosol: yellowish brown (10 YR 5/8) sandy loam matrix mottled and streaked with yellow (10 YR 7/6, 2.5 Y 7/4), brown (7.5 YR 5/6) and light gray (5 Y 7/1) sandy loam with some clay
K	Krotovina, noncultural disturbance
2	Arbitrary 10cm excavation level
F	Feature

Figure 20 Stratigraphy of Blocks A and B, 22It624.

well-controlled context. Two dates were obtained from the Late Archaic component associated with temporal markers. Feature 11 at the Beech site contained a Gary and a Little Bear Creek projectile point/knife which dated to 4,160±65 B.P. Feature 1 at the Oak site contained a Little Bear Creek, a McIntire, and a Benton projectile point/knife, which were dated at 3,850±65 B.P. Both dates are fairly consistent with others in nearby areas. Several Middle Archaic pits with diagnostic projectile point/knives were also dated. However, only two are consistent with others in this project. These are two dates from pits containing Benton projectile point/knives. At 22It623, a date of 5,310±70 B.P. was obtained from a pit containing only Benton projectile point/knives. One segment of Feature 7, a compound pit/landfill complex at the Oak site, contained a Benton projectile point/knife dated to 5,290±75 B.P. However, two other segments of this same feature dated 4,830±120 B.P. and 4,580±85 B.P. These segments did not contain projectile point/knives and likely are related to a later use of this area during the Late Archaic period. Feature 7 did contain one McIntire. This projectile point/knife type was associated with a 3,850±50 B.P. date in Feature 1 at this same site.

TABLE 30
Radiocarbon dates, 22It623 and 22It624.

Site/ Provenience	Lab #	C-14 Age B.P.	Uncorrected (Corrected) Calendar Age B.C.	Material	Cultural Affiliation
22It623/ Feature 11	DIC-2482	4160±65	2210 (2630-2680)	charcoal and nutshell	Late Archaic
22It623/ Feature 14	DIC-2483	5310±70	3360 (3980)	charcoal and nutshell	Benton
22It624/ Feature 1, Segment C	DIC-2470	3850±65	1900 (2180)	nutshell, oak, hickory, and hardwood	Late Archaic
22It624 Feature 7, Segment I	DIC-2484	4580±45	2630 (3190-3310)	hickory nutshell and charcoal	Benton?
22It624 Feature 7, Segment K	DIC-2485	4830±120	2880 (3410-3520)	hickory nutshell	Benton?
22It624 Feature 7, Segment Q	DIC-2487	5290±75	3340 (3490-3960)	charcoal and nutshells	Benton?
22It624 Feature 5, Segment A	DIC-2486	3600±55	1650 (2000-2020)	hickory nutshells and charcoal	Middle Archaic - Eva

* Corrections based on formula in Ralph et al. 1973.

The 3,600±55 B.P. date from the pit containing Eva, Beachum, and Residual Stemmed (Late Archaic?) projectile point/knives appeared to be associated with the latter projectile point/knife types. Excavation probably accounted for the presence of the Eva and Beachum components.

SUMMARY

The landforms of the Beech and Oak sites were two adjacent segments of the levee remnant which had been bisected by a small floodplain tributary stream. The levee was associated with the abandoned adjacent channel segment to the east, which likely contained the main channel of the Tombigbee when it was formed.

The stratigraphy consisted of two major zones. The upper meter (3.3 ft) of the site consisted of horizontal beds of sandy loam, the upper half of which was moderately stained from organics. Beneath this was truncated yellow-brown, well-developed paleosol which has been documented at three other floodplain sites in this project. The base of this zone was not exposed at these sites.

The investigations documented that these sites were occupied from the Early Archaic through the Late Woodland stages. Although data recovery focused on the Late Archaic, information on other occupations was obtained.

Archaic Stage: Perhaps the most surprising aspect of these sites was the discovery of the Early Archaic paleosol in an atypical landform to other occurrences.

Only a small sample of the paleosol was screened, and it produced chipped stone tools and debitage. No diagnostic projectile point/knives were recovered in the sample. However, there were three Kirk's recovered from the site, and these probably came from the paleosol. The initial Middle Archaic Eva/Morrow Mountain usually found in the top of the paleosol also was present. Although only one Eva was recovered, 11 Morrow Mountains were found. This supports the Middle Archaic occupation at the site, and the component is likely contained in the top of Strata VI (paleosol) and V and IV. This deposit appears light in artifact density, but has high integrity.

The late Middle Archaic Benton occupation signals a more intense use of these sites. The main archaeological deposits from this and the following Late Archaic occupation were pits. Unfortunately, the intensity of pit digging and mixing of both pit and midden material caused problems in interpretation of the activities. The presence of so many pits, however, indicates storage and/or refuse disposal during this and later periods.

The ceremonial blade cache, artifact clusters, broken siltstone atlatl, and many of the ornamental items probably were associated with either the Benton or Little Bear Creek occupations.

While the focus of the investigations at this site was the Late Archaic, Little Bear Creek period - corroboration of stratigraphic sequence was only partly successful, because it was difficult to separate the components. Mixing of materials mitigated against adequate interpretation. In spite of the mixing and poor association of pit features, the Benton occupation at this site was differentiated by fired aggregates from hearths and prepared areas with multiple hearths. These features suggest that the Benton period occupations was more transient than at Walnut, Poplar, and Ilex sites. The Benton occupation there also appears to have been light at the Hickory site as well.

Some settlements investigated had hearths and large prepared areas and burials, and others did not. The dates obtained on the Benton occupation are later than most other, yet still compatible, averaging 5,300±72 B.P.

Four pit features associated with the Little Bear Creek component; three were dated and averaged 3,870±61 B.P. These are the only ones thus far obtained associated with the Late Archaic Little Bear Creek horizon in the Upper Tombigbee Valley. The material in these pits included a wide assortment of chipped stone tools, ground stone tools, debitage, and charred plant remains, especially hickory nutshells. These materials indicate a wide range of activities, including subsistence-related, hide-working, and tool manufacturing activities. The presence of 53 Little Bear Creek and Flint Creek projectile point/knives support a substantial Late Archaic occupation of these sites. It is likely that at least some of not all of the 14 postmolds were from this occupation.

The remains of the later Gulf Formational and Middle Woodland occupations were mixed, but two Middle Gulf Formational and three Woodland pits were encountered. The Gulf Formational pits at the Oak site contained sparse material, but they provide evidence of stone tool manufacturing activities. The Woodland pits contained more material and revealed subsistence-related, tool manufacturing, hide and woodworking activities.

The investigations demonstrated that these sites were essentially abandoned after the Middle Woodland. Only intermittent visiting during the Late Woodland in inferred, and virtually no occupation during the Mississippian is documented.

EXCAVATIONS AT THE ARALIA SITE (22It563)

The Aralia site was located approximately 13.4 km (8.4 mi) northeast of Fulton, Ms (Figure 1). It was situated at the edge of the floodplain of the Tombigbee River (Figure 21). The Hickory site, a floodplain midden mound investigated in this project, was located only 750 m (246 ft) from the Aralia site in the floodplain. The site surface followed the steep slope (10-15%) of the wall in the eastern two-thirds, but was somewhat flatter (8-12%) in the western third and possibly extended on the floodplain edge. However, the western edge of the site had been disturbed by a dirt road and floodplain clear-cutting of the vegetation. The sloped surface of the site also had several erosional gullies and tree throws at the time of testing and excavation.

The site appears to have been a narrow sandy terrace lying against the valley wall which subsequently has been covered by colluvial and alluvial materials. Colluvial deposits resulted from downslope movement of the sandy sediments along the valley wall. Several seep springs occur at the base of the valley wall near the site at a similar elevation. Active small slumps and mass movement areas are common in this area.

FIELD METHODS

The site was initially located during a survey of the Canal Section of the Tennessee-Tombigbee Waterway by Blakeman (1976:19), who noted transitional Archaic/Woodland, Miller I, Miller II, and Miller III cultural material and recommended it for further testing. The site was tested in 1979 as part of the large-scale Canal Section testing program (Bense 1982). Testing included excavation of two 2x2 m (6.6x6.6 ft) units and a surface collection in the dirt road along the base of the slope (Figure 21). Testing indicated that while traces of Late Archaic through the Late Woodland period use were present, the site deposits were dominated by a middle Gulf Formational stage (Henson Springs phase) occupation. Little was known of this culture in the

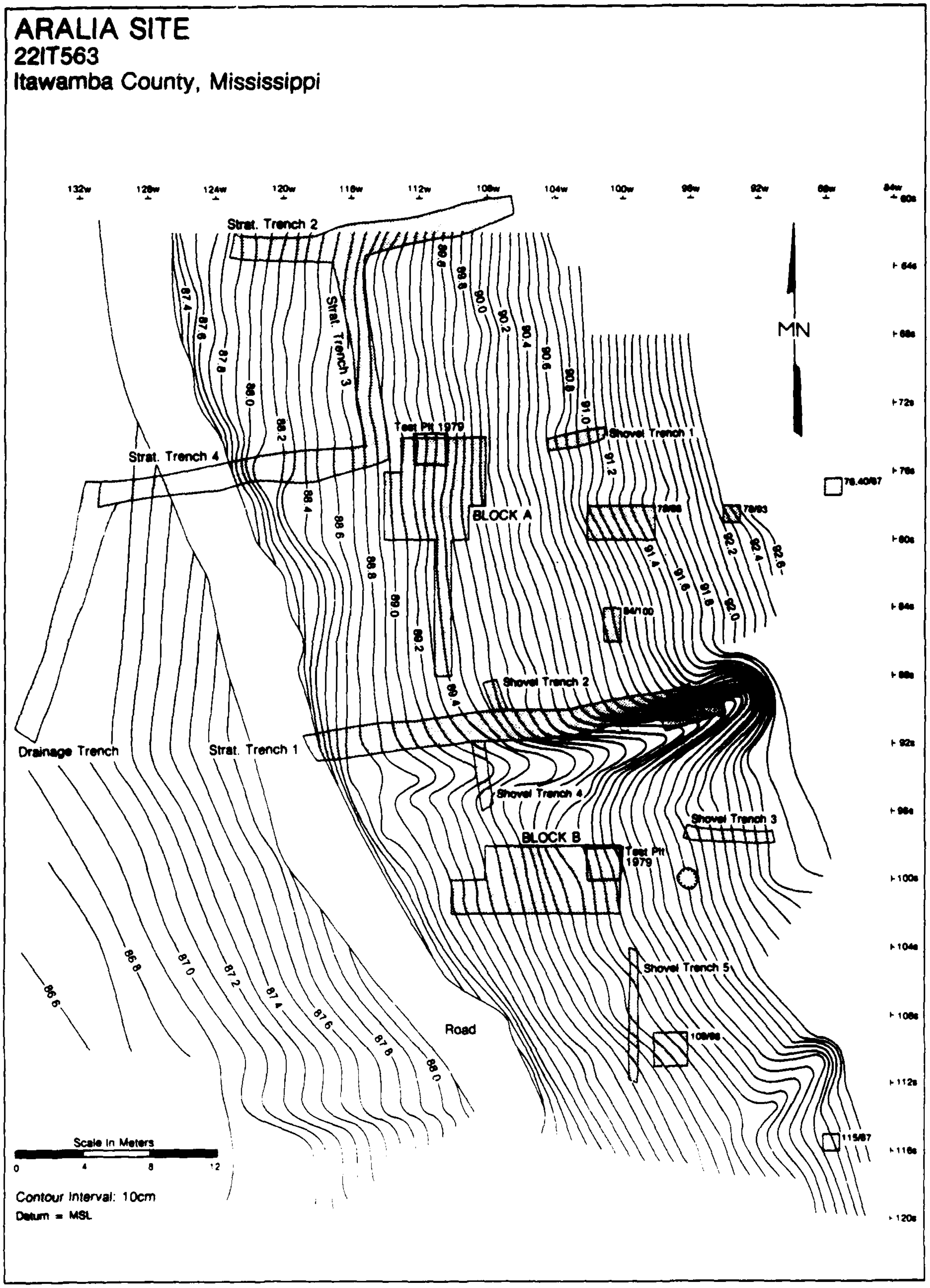


Figure 21 Topographic map and excavation plan, 22It563.

waterway at that time as the deposits in other sites had been mixed and at best limited to a few intact features. Because of the limited knowledge and the abrupt appearance and the unusual ceramic series associated with this culture, the isolation and integrity of this component at Aralia, it was recommended for data recovery.

Excavations were conducted at the Aralia site between November of 1978 and March of 1981. The objective of the investigations was the recovery of a good sample of the Henson Springs component. As at the Ilex site, which was under investigation at the same time, backhoe trenches (five) were the initial means of site investigation to aid in the placement of hand-excavation units. These provided information on the extent of the site, since the midden zone was buried 20-30 cm (7.8-11.8 in) below the surface. The midden appeared to be discontinuous, approximately 50 m (165 ft) north-south by 40 m (132 ft) east-west. Based on the information from the trenches and test units, the two test units were placed in areas of the richest midden deposits, and these were expanded accordingly (Figure 21). No chemical or visual coring was performed, since the necessary information had been obtained through stratigraphic trenching.

The main excavation units were initially 4x4 m (13.2x13.2 ft) in size (A and B; Figure 20). These units were later expanded to follow features and exposed midden. Block A eventually incorporated 40 sq m of excavated area, while Block B contained 36 sq m. To explore the horizontal extent of the site and to identify possible activity areas, an additional seven 1x2 m (3.3x6.6 ft) test units and two 1x1 m (3.3x3.3 ft) units were placed to the east and south of Blocks A and B. Four shovel trenches were excavated by hand to investigate the extent of the midden or features exposed in other units. These were 50 cm (1.6 ft) deep and varied from 2 m (6.6 ft) to 8 m (26.4 ft) in surface area.

CULTURAL REMAINS

Artifacts recovered from the site included ceramics, stone tools, historic artifacts, and floral and faunal remains. The following sections summarize each material class recovered from the site.

A total of 3,041 sherds were recovered from Aralia (Table 31). While four temper types were present, grog, limestone, and fiber made up only 2.1% of the sample. Sand-tempered ceramics dominated the assemblage (97.9%) and of the specimens identified, 69% were Henson Springs types (Alexander series, Columbus Punctate or Smithsonia Zone Stamped). The combination of Henson Springs with the large amount of Plain (28.2%), suggests strongly that this was the Henson Springs culture of the late Gulf Formational stage. The few fiber-, limestone-, and grog-tempered sherds (65) likely reflect short visits during these cultural episodes.

While sand-tempered ceramics were usually the most frequent types encountered in most floodplain sites investigated in this project. The Aralia site yielded them at the rate of 60-70% greater than other sites. Other ceramic assemblages contain a much lower percentage of diagnostic Henson Springs ceramics (ca. 10-20%) than the 69% from Aralia.

TABLE 31
Ceramic frequencies by temper, 22It563.

Temper	Frequency	Percentage
Grog	47	1.5
Limestone	9	0.3
Sand	2,976	97.9
Fiber	9	0.3
Total	3,041	

A total of 983 chipped stone artifacts were recovered from the site (Table 32). As in most assemblages in this project, there was a high percentage (40.9%) of fragments of unidentifiable chipped stone tools. This category was included in the "Other Uniface and Biface Tool" group, and caused it to be the most frequently (43.8%) encountered of the chipped stone tools. The second most frequent tool type recovered was projectile point/knives (30.7%). The relative amount was even higher (52%) if only identifiable tools were considered.

Findings here agreed with the other floodplain assemblages, except for the high range of projectile point/knives. The Hickory site, only 750 m (2,461 ft) away, had a similar high percent of projectile point/knives.

TABLE 32
Chipped stone tool frequencies by type, 22It563.

Tool Class/Type	Frequency	Percentage
Projectile Point/Knives		
Cotaco Creek	1	
Flint Creek	98	
Gary	2	
Little Bear Creek	36	
Mud Creek	1	
Residual Stemmed	10	
Wade	1	
Distal fragment	66	
Medial fragment	27	
Proximal fragment	51	
Subtotal	293	30.7
Bifaces	64	6.7
Preforms	91	9.5
Cores	15	1.6
Scrapers	27	2.8
Drills, Perforators, etc.	46	4.8
Other Uniface and Biface Tools	417	43.8
Total	983	

Preforms (9.5%) and bifaces (6.7%) were the next in frequency among chipped stone materials. The drills and perforator group followed with 4.8%, and cores were found at the lowest rate.

A total of 1,881 utilized flakes were also recovered from the site. This large number reflects a consistent use of these expedient and disposable tools. The 0.5 inch (1.3 cm) flakes were almost as abundant (43.8%) as the 0.25 inch (.64 cm) flakes (49.9%), indicating selection of larger flakes, rather than a proportional use of available flakes.

A total of 43,475 flakes of debitage were present in the Aralia assemblage. The dominant raw material was Camden chert (97.3%), 85.7% was heated. The remaining 2.7% of the debitage was made up of several local and exotic raw materials.

Small, 0.25 inch (.64 cm) flakes (87.2%) dominated, 0.5 inch (1.3 cm) (12.7%) were next in abundance, and few flakes greater than one inch (2.54 cm) in size (0.1%) were recovered (Table 33). The debitage was quite localized, and the 2x2 m (6.6x6.6 ft) test unit 76.4S/87W that was the furthest upslope (Figure 21) contained the most debitage and the highest proportion of projectile point/knives. The 2x4 m (6.6x13.2 ft) unit 4 m (13.2 ft) to the west (78S/98W) contained the largest amount of debitage.

TABLE 33

Size-grade frequencies of debitage, 22It563.

Size Grade	Frequency	Percentage
1.0 inch	39	0.1
0.5 inch	5,501	12.7
0.25 inch	37,935	87.2
Total	43,475	

The tool-to-debitage ratio at this site is 1:46, one of the lowest ratios of all sites investigated in this project. The proportion of flake sizes is 1:141:973, also the lowest of all sites. The likely reflects that tool manufacturing was a primary activity at this site which results in a lot of debitage.

A total of 145 ground stone implements were recovered from the Aralia site. Most (71.0%) were fragments of unidentifiable tools (Table 34) and flakes of tools (13.8%). Of the 22 identifiable ground stone tools, the most abundant were hammerstones (5.5%). Pounding stones such as mullers, mortars and anvilstones were also present (7.0%). Ground hematite, limonite, and a stone bead implied personal adornment.

TABLE 34

Ground stone tool frequencies by type, 22It563.

Tool Class/Type	Frequency	Percentage
Hammerstone	8	5.5
Pitted Anvilstone	3	2.1
Muller	3	2.1
Mortar	4	2.8
Bead	1	0.7
Ground Limonite	1	0.7
Ground Hematite	2	1.4
Unidentified Ground/Polished Stone Fragment	103	71.0
Other (Ground Flake)	20	13.8
Total	145	

A total of 94,868 grams of introduced rock was recovered from 22It563. Sandstone was the most abundant material found, followed by cobble/pebbles. Fire-cracked chert chunks and petrified wood were next in abundance. One cautionary note should be made, however, concerning the amount of introduced rock. Sandstone and cobble/pebbles (91.2% of the group) occur naturally in the sediments of the site, and the amount brought on the site by the former occupants could not be determined.

The historic remains were recent and consisted largely of dumped household debris. Shell casings were also a frequent surface artifact reflecting local hunting activities.

Faunal remains from 22It563 were represented by a few very small and usually calcined fragments. Since these samples were too fragmentary to permit positive indentification, no further analysis of these samples were conducted.

FEATURES

A total of 12 features were identified at the Aralia site and all were apparently associated with the Henson Springs occupation. The features included:

8 ceramic clusters
2 pits
2 dark stained midden features

All the ceramic clusters were concentrations of fragments from single broken vessels. The clusters were all lying on or in the buried midden zone (Strata IV) and were not contained in any visible pit. Apparently they were piles of sherds (and occasionally other materials) which were at or near where the vessel had broken. Of the eight vessels, the ceramic types included five Alexander Pinched, two Alexander Incised, and one Residual Plain. At least two of the vessels were wide-mouth utilitarian bowls.

The broken vessel concentrations in Block A (four) and two in Block B were outside the dark organically stained midden of Features 10 and 11, respectively. In addition, one ceramic cluster was found in test unit 78N/98W and 84N/100W. These were found within the Henson Springs midden zone, the apparent occupation land surface of the time.

The two pits encountered, both in Block B originated in the midden zone containing the Henson Springs component and were outside the dark organically stained midden of Features 10 and 11. One contained diagnostic Alexander Pinched ceramics. These features were, apparently, small V-shaped gullies filled with refuse, rather than purposefully dug pits. They were similar in size: 43 cm (1.4 ft) long, 40 cm (1.3 ft) wide, and 45 cm (1.5 ft) deep.

The largest and most complex features encountered at this site were the two large organically stained areas designated as Feature 10 in Block A and Feature 11 in Block B. In both cases, only the eastern edge of the features was defined, and the block units were extended to the west in efforts to find the western perimeter. The exigencies of time, however, precluded the completion of that task. The features appeared to have been organically stained, somewhat more compact and circular than areas within the midden zone which were present in most of these sites.

Convoluted sediments were found along the top of the features. The sediments were not homogeneous, and small lenses ca. 50 cm (1.8 ft) in diameter and 5-10 cm thick (2-4 in) thick were identified. Some mixing with the subsoil was noted in the field. These features were probably either dumps or areas of residential activity. The features both contained a higher density of cultural material than other midden areas.

STRATIGRAPHY

The site stratigraphy was characterized by sandy, alluvial and colluvial sediments. Lamellae were common below 60 cm (1.97 ft) and were probably associated with a perched water table levels. The depositional record at 22It563 documented periods of extensive erosion, colluvial deposition, super-saturation and flooding produced by Tombigbee River flooding. These processes continue to affect the site environment to the present, and no doubt they had a significant influence on prehistoric settlement of the eastern valley margins.

One of the more peculiar aspects of the Aralia site was the steep slope of the site surface. The present slope was approximately 10% and examination of stratigraphic profiles revealed that the slope of subsurface units toward the floodplain reached 15%.

The surface at the site and adjoining areas at the base of the valley wall were alternatively experiencing episodes of erosion and deposition at the time of excavation. Rivulet, channel cutting, and downslope movement were all active. The base of the slope at the western edge of the site revealed cut-and-fill deposits probably due to the meandering of the Tombigbee or tributary streams. A channel could have been active in this position during some of the prehistoric occupations.

In all likelihood, the base of the slope did contain evidence of prehistoric settlement that was destroyed by erosion and recent disturbance by improvements to the access road. The recovery of 21 Wheeler sherds in this road during the 1979 (Bense 1982) testing investigations provided the only indication of the temporal placement of occupations in this area. It is noteworthy also that the position of the river was likely much closer to the eastern valley wall than currently (1 km: 0.6 mi), as indicated by the cut-and-fill deposit along the toe of the slope. If so, this may have been an important factor in the selection of the site area for settlement.

Nine strata were identified at the Aralia site (Figure 22). All were loams or sandy loams with high sand contents. One stratum (II) 20-40 cm (7.8-19.7 in) below the surface had been visibly altered by the introduction of organics, and it contained the most cultural material. Although this zone was darker than non-culturally modified zones, it was not as dark as the floodplain midden zones.

CHRONOMETRIC DATING

One radiocarbon date was obtained from Zone 2, the cultural midden of the Henson Springs. The date was 2,379±50 B.P., which is consistent with the few other dates of this culture in the Tombigbee Valley. The date, along with a paucity of ceramic types such as Smithsonia Zone Stamped and Columbus Punctate, confirm the occupation of the site early in this phase.

SUMMARY

The investigations conducted at the Aralia site confirmed that the primary occupation was during the Henson Springs phase. The materials and features within Zone 2 exhibited no mixing and can be considered as an isolated component of this phase. However, the distribution of artifacts within the upper three stratigraphic zones revealed the predominance of Alexander series ceramics and Flint Creek/Little Bear Creek projectile point/knife forms, regardless of stratigraphic position. Secondary occupations were present, although they were limited. These components were identified Wheeler, Baytown, and Miller ceramics. The majority of these were recovered from the surface of the site along the base of the slope during testing (Bense 1982) or from disturbed contexts within the Block B excavation unit.

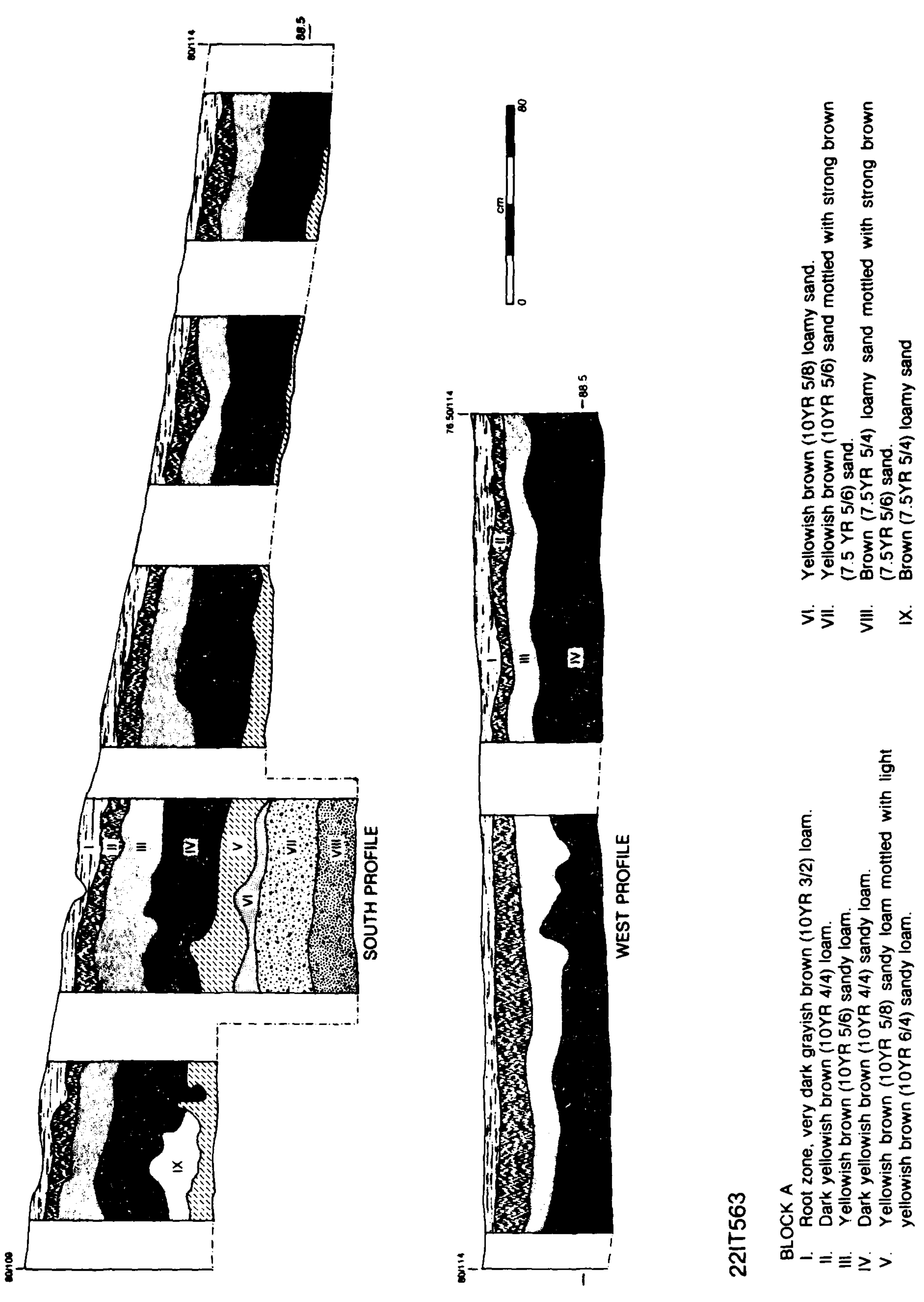


Figure 22 Stratigraphic profile of Block A, 22It563.

The Henson Springs assemblage was characterized by its homogeneity across the site. Although eroded sand-tempered sherds comprised the majority of the overall ceramic sample, the Alexander series, including pinched and incised varieties, which constituted the majority of the decorated sherds. A detailed study of this important assemblage is presented in Chapter IX of this report. Lithic implements were dominated by complete and fragmentary Flint Creek/Little Bear Creek projectile point/knives, i.e. 13.8% of all chipped stone tools and 90.9% of all identifiable projectile point/knives. Other implements included relatively limited numbers of bifaces and cores and a variety of preforms, scrapers, and drills-perforators-reamers. Although scrapers occur in a variety of styles, they are outnumbered by drills-perforators-reamers by a ratio of approximately 2:1. Overall, chipped stone lithic debitage and implement samples reveal that stone tool manufacture was at least a consistent activity and an overwhelming preference for heated Camden chert (97.3%). Finally, ground stone implements were poorly represented in this assemblage; however, several mullers, mortars, pitted anvilstones, and a single, fragmentary bead were recovered. The diversity of lithic implements suggest a wide range of activities within the Henson Springs phase component.

Occupation at the site was apparently semipermanent, although some movement of population to other sites during portions of the year probably occurred. The relatively low number of items in certain implement categories (e.g., ground stone, scrapers) suggests a low occupation intensity, a limited number of intermittent, semipermanent occupations, and/or use of multipurpose tools. The projectile point/knife forms were used for a variety of purposes, e.g., projectile, knives, drills/perforators, which perhaps obviated the need for other specialized tools.

The lithic sample from 22It563 provided further clarification of the stylistic elements and the technological patterns in an assemblage from the Henson Springs phase in the Upper Tombigbee Valley. As indicated earlier, both the Flint Creek and Little Bear Creek projectile point/knives in this sample were probably a part the Henson Springs assemblages. Although separated for descriptive purposes, these two forms overlap in terms of stylistic attributes, size, and technology of manufacture.

Early stages in the hafted biface reduction were represented by Stage 1 and 2 preforms. Primary and secondary decortication flakes produced by the reduction of cobbles to the preform stage were not well represented in the debitage suggesting that at least some initial reduction took place off-site at the sources of cobbles. The initial manufacturing sequence at the site apparently involved both bifacial reduction of cobbles and large flakes derived from cobbles. The reduction of relatively large flakes, or possibly split cobbles, appears to have been the favored starting point in the production of projectile point/knives in this sample.

The more extensive shaped and thinned stage is reflected in the biface blades. The retention of flat, unthinned bases on finished bifaces is evidence of the initial striking platform produced by a proximal flake-blank orientation. Flat or faceted bases, often consisting of cobble cortex, commonly occurred in samples of Flint Creek and Little Bear Creek projectile point/knives (Jolly 1971:18; Cambron and Hulse 1975:51,82). This is particularly true of this assemblage and others from the Upper Tombigbee Valley. Nearly half of the 98 Flint Creek projectile point/knives in this sample have faceted or "unfinished" bases.

In the distribution of materials and features at the Aralia site, three analytical units were formulated: Zone 1 included all strata and materials in

Strata I-III, levels above the midden horizon, Zone 2 was the defined midden, and Zone 3 included all strata below IV. This isolated the concentration of cultural debris in the dark-colored midden, Strata IV, including the two large stained midden features (10 and 11) which appear to have been coeval segments of a discontinuous cultural midden. Outside of these areas, the cultural zone was much lighter in organic staining with a gradual horizontal change from the features. In the excavation units placed furthest upslope no staining was encountered; however, cultural debris was still confined to Strata IV.

The artifacts recovered from Block A and B indicated possible differences in the kinds of activities conducted in each area. Block B had more cultural material, although the ceramic frequency recovery was nearly identical. Block B had some mixing of diagnostic ceramic types and no such mixing was apparent in Block A. Lithics in the two blocks revealed larger numbers and a greater diversity of lithic implements in Block B, with an emphasis on maintenance/rejuvenation, and some secondary manufacturing. Perhaps this was the location of a lithic workshop.

In contrast, the tools in Block A assemblage had a wide range of types suggesting a gradual accretion of debris. The occurrence of the dark-colored midden areas in both blocks also implied extractive or residence activities that resulted in the deposition of organic residue.

As noted previously, the 2x6 m (6.6x19.7 ft) (78S/98W) test unit produced a disproportionately high number of projectile point/knives. Of these, 28 (62%) were classified as Flint Creek. Preliminary examination indicated multiple uses such as drilling, cutting, and projectiles. Perhaps some maintenance and/or rejuvenation of these implements was also represented. The fact that the midden in Blocks A and B was not present in this upslope area suggested that it was not an intensive processing area for biotic resources.

The Henson Springs component was interpreted as a base camp settlement. This interpretation was based on the diversity of implements, as well as activities. The time span of the occupations represented within midden Strata IV was most likely no more than several hundred years. Components bracketing the Henson Springs occupation were represented, but such occupations were apparently of shorter duration and intensity.

EXCAVATIONS AT SITE 22It606

Site 22It606 was located approximately 13 km (20.8 mi) north of Fulton, in Itawamba Co., Ms (Figure 1). The site was situated on an isolated segment outlier of the valley wall which was part of the Pleistocene terrace overlooking the floodplain of the Tombigbee River. Mud Creek flowed along the southern and eastern borders of the landform and separated it from the adjacent uplands by downcutting in the soft sandy sediments. The surface area of the terrace remnant was approximately 60x140 m (196x460 ft). The southern and western edges of the landform were very steep (Figure 23), however, the east and north slopes were much more gradual. The site area was perched 4.5 m (14.8 ft) above the floodplain and adjacent to it. The site had been cleared and a homesite, garden, and store were just being demolished at the time of testing in 1975, and heavy machinery associated with waterway construction had damaged the northeastern third of the site area.

FIELD METHODS

The site was tested in Phase I of this project between September and October 1980 and included a controlled surface collection and two 2x2 m

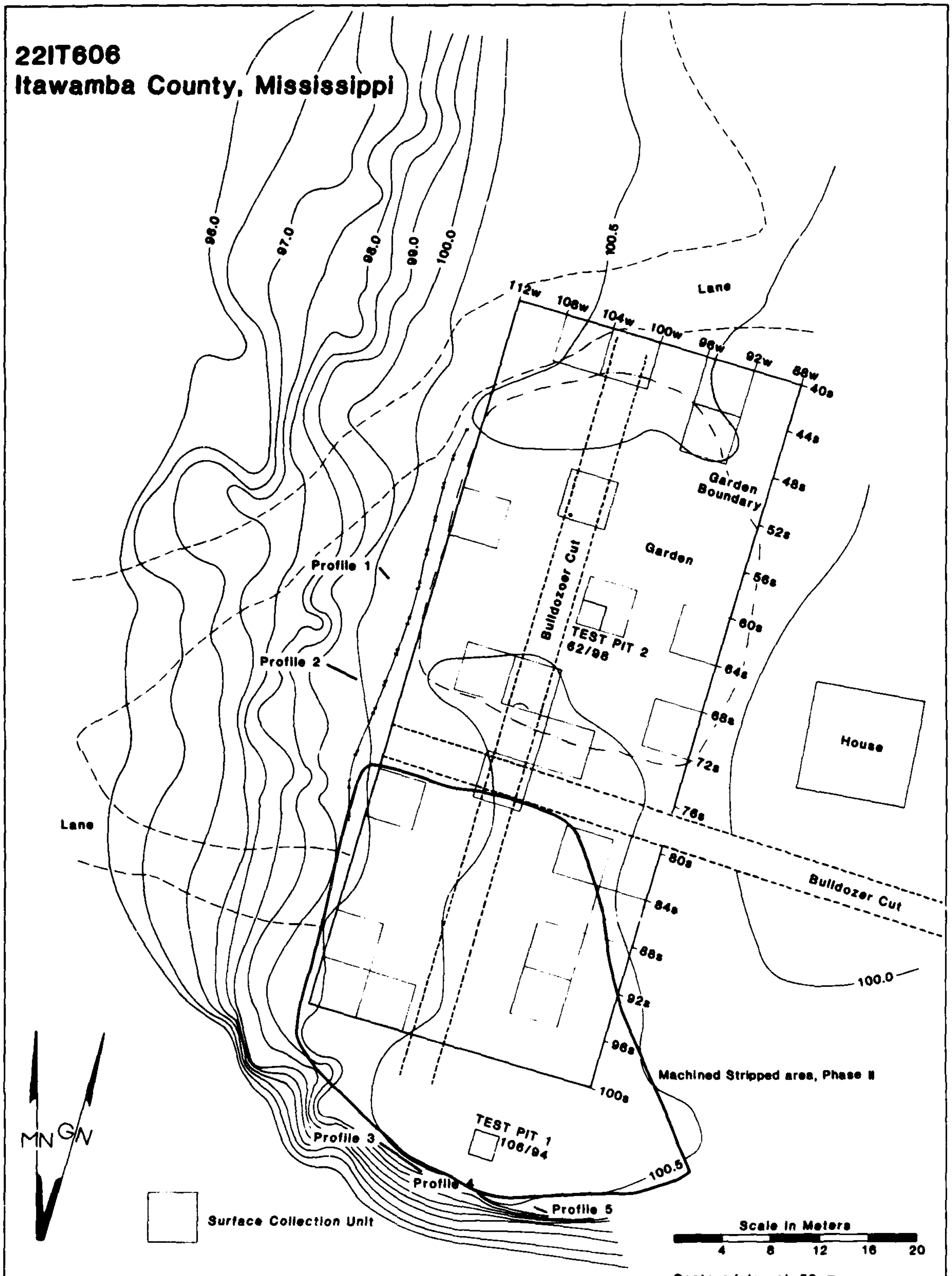


Figure 23. Topographic map and excavation plan, 22It606.

Figure 23 Topographic map and excavation plan, 22It606.

(6.6x6.6 ft) units in areas which produced materials diagnostic of a Late Woodland/Mississippian occupation (Figure 23). The test units were excavated to an average depth of 100 cm (3.25 ft). Five additional stratigraphic cuts averaging 50 cm (1.8 ft) deep were made to obtain data on cultural and natural stratigraphy and geomorphological processes at the site. Testing also included machine-stripping of the plow zone in two 2.5 m (8.2 ft) wide trenches across the site. This exposed 14 prehistoric features below the plow zone, all of which were either completely removed or sampled. The information from testing revealed that this site contained intact features of the Late Woodland/Mississippian period. In all other sites investigated in the Upper Tombigbee Valley in this project, this component had consistently been very mixed through looting and/or cultivation. Features at this site of the late aboriginal occupation of the area, made it a logical choice for excavation to recover a good sample of the Late Woodland/Mississsippian features.

Intensive data recovery was conducted in Phase II of this project during December of 1981. The focus of these investigations was to expose the Late Woodland/Mississippian features and excavate a representative sample.

After clearing of the vegetative cover, mostly tall weeds, with a tractor and bush hog, the plow zone south of the east-west testing trench was machine-stripped with a bulldozer. A smaller dozer then removed the final few centimeters over the features. The dark stains contrasted with the lighter, yellower, subsoil were flagged and initially investigated by shovel skimming. The features were then excavated using the standard procedures.

CULTURAL REMAINS

Cultural materials retrieved from 22It606 investigations included ceramics, lithic materials, historic artifacts, and biotic remains.

A total of 1,730 sherds were recovered from the site, and they consisted of five major temper groups: shell, grog, bone, limestone, and sand. Sand-tempered sherds were the most frequent (45.1%) usually followed by grog (37.8%) (Table 35). Shell-tempered ceramics were the next most frequent (11.7%), while limestone (3.3%) and bone (2.1%) were the least frequent. The Late Woodland diagnostic temper types (grog, bone, and shell) when combined, dominated the assemblage (51.6%). The sand-tempered ceramics included a few late Gulf Formational (1.3%) and Middle Woodland types (10.6%), however, the bulk was composed of either eroded or plain specimens (88.1%).

TABLE 35

Ceramic frequencies by temper, 22It606.

Temper	Frequency	Percentage
Shell	202	11.7
Grog	654	37.8
Bone	37	2.1
Limestone	57	3.3
Sand	780	45.1
Total	1,730	

A total of 457 chipped stone tools were recovered from the site (Table 36). The most frequent category was Other Uniface and Biface Tools (69.6%). However, most were (97.5%) fragments of unidentifiable tools. The next most frequent category was projectile point/knives (16.4%). Scrapers which was (59.4%) of the identifiable chipped stone tools. Bifaces were the next most frequent tool type (8.5%), followed by scrapers (3.9%), and drilling and perforating tools (1.5%). Cores and preforms followed the general assemblage pattern of this area with (0.2%).

TABLE 36
Chipped stone tool frequencies by type, 22It606.

Type	Category	Frequency	Percentage
Projectile Point/Knives			
	Big Sandy Side-notched	1	
	Flint Creek	1	
	Little Bear Creek	1	
	Kirk Corner-notched	7	
	McIntire	1	
	Mississippian-Woodland Triangular	24	
	Residual Stemmed	3	
	Sykes-White Springs	1	
	Tombigbee Stemmed	3	
	Distal fragment	4	
	Medial fragment	3	
	Proximal fragment	2	
	Lateral fragment	1	
	Unidentified fragment	23	
	Subtotal	75	16.4
Scrapers		18	3.9
Drills, Perforators, etc.		7	1.5
Other Uniface and Biface Tools		316	69.1
Bifaces		39	8.5
Preforms		1	0.2
Cores and Preforms		1	0.2
Total		457	

A total of 253 utilized flakes were also present in this assemblage. The proportional amount of flake size followed other assemblages with a low amount of flakes larger than one inch (2.8%) and an almost equal amount of 0.5 in (1.3 cm) and 0.25 inch (.64 cm) (45.1% and 46.6%, respectively). Other utilized chunks and blade-like flakes made up the remainder of this disposable tool type.

A total of 3,286 pieces of unmodified flaking debris were retrieved. The proportional distribution by size was as follows: one inch (2.54 cm) (132: 0.4%), 0.5 inch (1.3 cm) (1,375: 11.4%), and 0.25 inch (.64 cm) (2,383: 72.5%). Clearly, stone tool manufacture and maintenance did occur at the site.

Proportions were also different from the modified debitage due to the preforms for larger flakes. Heated and unheated Camden chert types were dominant, comprising 73.0% and 12.7%, respectively. The next most important raw material was Fort Payne chert (6.7%) and chert, comprising 92.4% of the total debitage.

The tool-to-debitage ratio is 1:7, in the high range of sites investigated. The proportion of flake size is 1:10:18, which was much higher than at other sites reflecting a lower amount of stone tool manufacturing at this site as reflected in the feature fill.

Only 18 specimens of ground stone tools were recovered from 22It606 (Table 37). Tool types included four hammerstones (22.2%), three mortars (16.7%), and one each of ground limonite and ground hematite and mullers. The most frequent category was fragments of unidentifiable ground stone tools (44.4%), and unidentified ground stone tools (n=4).

TABLE 37
Ground stone tool frequencies by type, 22It606.

Type	Frequency	Percentage
Hammerstone	4	22.2
Mortar	3	16.7
Ground Limonite	1	5.6
Muller	1	5.6
Ground Hematite	1	5.6
Unidentified Ground Stone	8	30.9
Total	18	

A total of 345.6 kg of unmodified rock was introduced to the site and recovered in the investigations. As in other sites it consisted primarily (80%) of local sandstone.

The historic artifacts recovered from 22It606 were recent. A wide shallow historic dump area was located at the site.

Only two grams of unmodified animal bone were recovered from the site. The sample specimens were too small and fragmentary to allow any taxonomic or element identification.

FEATURES

A total of 29 features were encountered in the investigations at Site 22It606, they included:

22 pits
5 posts or post molds
1 fire basin
1 sandstone cluster
1 trash dump

Of the 22 aboriginal pits, the cultural affiliation of 14 could be determined, i.e. 12 from the Late Woodland/Mississippian period and one each from the Late and Middle Archaic.

The Late Woodland/Mississippian pits were usually circular to oval in shape with basin-shaped profiles and flat bases. The size ranged from 18-35 cm (7 in - 13.8 ft) in diameter and 10-62 cm (3.9 in - 2 ft) deep. This wide range in diameter was unusual in this part of the valley. The pits often had clearly defined strata from separate filling episodes, and two had been fired. The Middle Archaic pit contained an Eva projectile point/knife deep within the 62 cm (2.0 ft) of fill. The pit assigned to the Late Archaic, however, is more tenuously affiliated, since the diagnostic projectile point/knives were recovered from the uppermost portion of the pit. Eight of the pits contained no ceramics and no diagnostic projectile point/knives, and the cultural affiliation cannot be determined.

The fire basin was a large complex feature 302 cm (9.9 ft) in diameter with a basin-shaped profile containing a central pit 25 cm (9.8 in) deep. This was contained in a basin lined with red fired soil 21 cm (8.3 in) thick. While this contained some ceramics from the late Gulf Formational and Historic periods, it was probably from the Late Woodland/Mississippian period.

The five postmolds did not contain any diagnostic material and could not be assigned to any cultural period. The distribution suggested no discernible pattern either.

The sandstone cluster was a pile of broken fragments surrounded by dark soil with a rounded base. The pile was 45x50 cm (1.5-1.6 ft) in size and 22 cm (8.7 in) deep. These rocks were purplish red in color and appeared to have been heated. The cultural affiliation of this feature could not be determined.

STRATIGRAPHY

Site 22It606 generally consisted of colluvial and alluvial sediments combined with organic and some cultural residues, overlying the Pleistocene terrace, which is mostly weathering in situ and exhibited a mature, well-developed soil. Five strata were defined at the site (Figure 24). The upper 60-80 cm (2-2.6 ft) contained the cultural material and was organically stained, the upper 20-30 cm (7.8-11.8 in) of which had been plowed. These strata, however, were much lighter than the midden in the floodplain below. The intact midden below the plow zone varied in thickness from 25 cm (9.8 in) in the northern part of the site to 50 cm (1.6 ft) near the southern edge. Below these upper strata there had been no cultural alteration of the deposits. Immediately below were two alluvial deposits on a mature, well-developed soil characteristic of the upland Pleistocene in this area. It had a well-developed prismatic structure with reticulate mottling throughout.

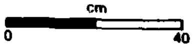
CHRONOMETRIC DATING

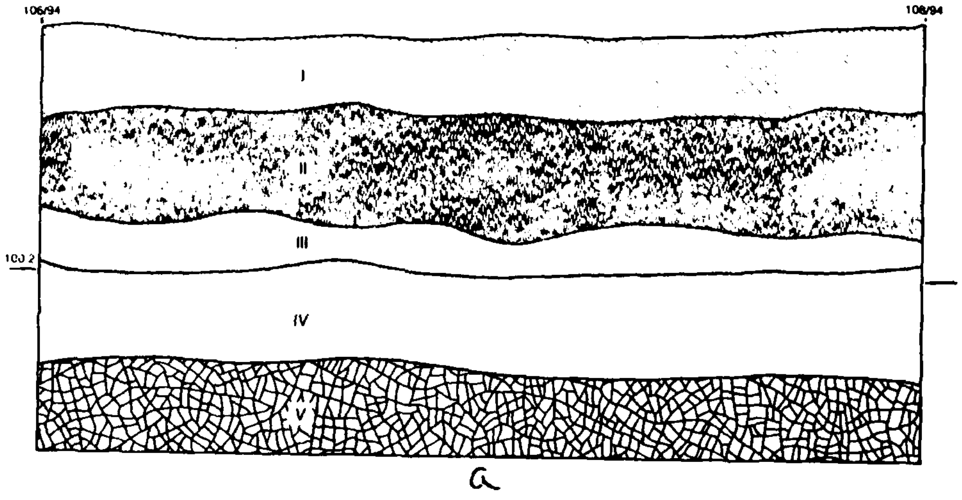
Six radiocarbon dates were obtained from this site (Table 38). All were obtained from features with clear cultural affiliation. The dates ranged from 5,800±60 B.P. to 412±50 B.P. The earliest date was from the pit that contained a Sykes-White Springs projectile point/knife, and it was consistent with other dates of this period obtained in this area. The remaining five dates were all from Late Woodland/Mississippian pit context and ranged from 860±60 to 412±50 B.P. (A.D. 1,170-1,440). Although these dates may seem late for the Late Woodland/Mississippian period, the internal consistency (within the site) strongly suggests that during A.D. 1,100-1,440 the Upper Tombigbee population was not "Mississippianized," and the people retained basically a Late Woodland culture.

TABLE 38
Radiocarbon dates, 22It606.

Feature/ Provenience	Lab #	C-14 Date	Uncorrected (Corrected) Date *	Material	Cultural Affiliation
14	DIC-2057	412±50	A.D. 1538 (A.D. 1440)		
18 Segment C (middle stratum)	DIC-2447	600±80	A.D. 1350 (A.D. 1350)	wood charcoal	
18 Segment E (next to lowest stratum)	DIC-2450	680±80	A.D. 1270 (A.D. 1290-1260)	wood charcoal	

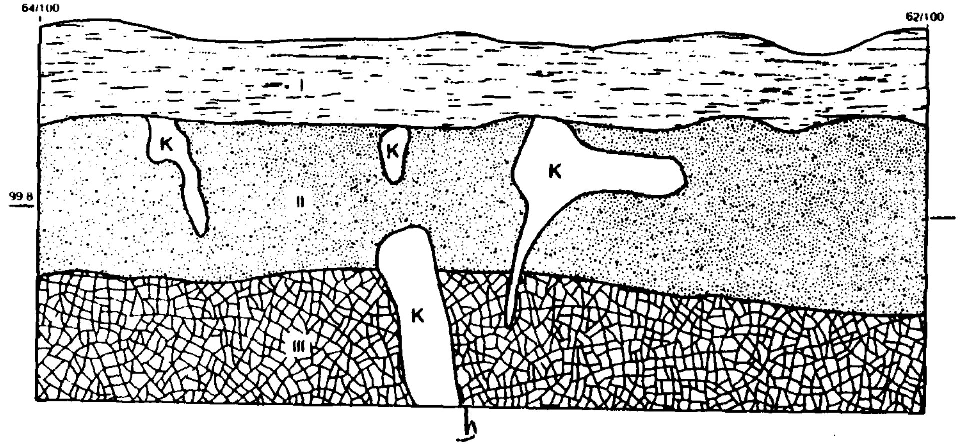
22IT606





TEST PIT 1 (106s/94w)
East Profile

I. Dark brown (7.5YR 3/4) sandy loam, plowzone (?).
II. Strong brown (7.5YR 4/6) loam to sandy loam.
III. Strong brown (7.5YR 4/6) sandy loam, mottled with yellowish brown (10YR 5/8) sandy loam, transitional zone, increasing compaction downward.
IV. Yellowish brown (10YR 4/6) sandy clay loam, manganese staining on ped surfaces, small manganese nodules dispersed throughout, increasing compaction downward.
V. Yellowish brown (10YR 5/8) sandy clay loam, small manganese nodules dispersed throughout, beginning of reticulate mottling (light grey, 10YR 7/2), very compact.



TEST PIT 2 (62s/98w)
West Profile

I. Strong brown (7.5YR 4/6) sandy loam, plowzone.
II. Dark yellowish brown (10YR 4/6) sandy loam, small manganese nodules dispersed throughout.
III. Dark yellowish brown (10YR 4/6) sandy clay loam, beginning of reticulate mottling (light brownish grey, 10YR 6/2), very compact.

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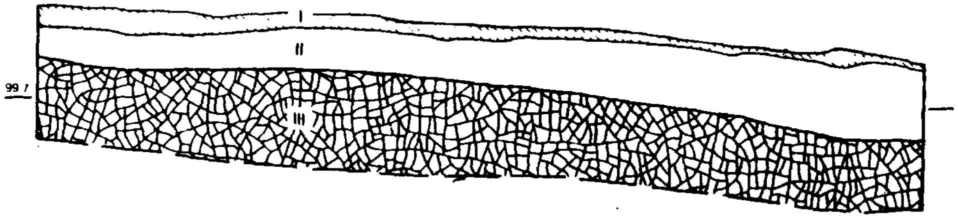


PROFILE 2
South Face

I. Dark brown (7.5YR 3/4) sandy loam.
II. Yellowish brown (7.5YR 5/8) sandy loam, small nodules of manganese dispersed throughout
III. Yellowish brown (10YR 5/8) sandy clay loam, mottled with yellowish brown (10YR 5/6), sandy loam, small manganese nodules dispersed throughout, beginning of reticulate mottling (light grey, 10YR 7/2).

Figure 24 Stratigraphic profiles, 22It606.

TABLE 38
Radiocarbon dates, 22It606 (continued).

Feature/ Provenience	Lab #	C-14 Date	Uncorrected (Corrected) Date *	Material	Cultural Affiliation
20 Segment B, (middle stratum)	DIC-2449	730±55	A.D. 1220 (A.D. 1240)	wood charcoal	
28 Segment B (middle stratum)	DIC-2451	580±60	3850 B.C. (4490 B.C.)		Middle Archaic
45 North 1/2	DIC-2448	860±60	A.D. 1090 (A.D. 1170-1110)	wood charcoal	

* Corrections based on formula in Ralph et al. 1973.

SUMMARY

Site 22It606 was located high above the floodplain on a flat-topped Pleistocene terrace which had been cut off from the uplands by a small tributary stream (Mud Creek). The site had been occupied intermittently since the Early Archaic period to the present; however, the major occupation was during the Late Woodland/Mississippian period (A.D. 1,100-1,440). The investigations focused on the features from this occupation, 12 of which could be definitely documented (all pits). Other features likely associated with the Late Woodland/Mississippian component were a large fire hearth and sandstone cluster. During this period, the site was apparently intermittently occupied.

Some trends in the change of tempering was documented by radiocarbon dates. During the Late Woodland/Mississippian period grog tempering was predominant, comprising 50-60% of the ceramic assemblage, except from about A.D. 1,250 to possibly A.D. 1,400, when it was 70-90%. The largest tempering minorities were shell, shell-and-grog, and sand. Bone- and limestone-tempered sherds were rarely encountered.

The shell-tempered ware was probably the most sensitive time indicator. Although infrequently found, it displays meaningful temporal variations. Shell tempering was apparently introduced early, perhaps by A.D. 1,000, and it comprised at least 30% of the ceramic assemblage. By A.D. 1,250, it accounted for less than 5% of the sherds, and in very late prehistoric increased to its original frequency. A detailed modal analysis of this ceramic assemblage was performed and is presented in Chapter IX of this report.

Other materials provided information about the Late Woodland/ Mississippian. Most features contained a proportionately large quantity of lithic tools and debitage. The majority were relatively small pits, possibly suggestive of short-term, recurring occupation or use. Several of the pits were stratified, suggesting reuse, and some had large amounts of secondarily deposited charcoal. The lack of prepared areas, ceremonial features, burials, or structural remains reflects a utilitarian and short-term use of the site.

Several Kirk points, both in the general midden and in the features are indicative of an Early Archaic occupation. In some cases, Feature 2, it appeared that these artifacts were collected and reutilized by later groups. Feature 28, with diagnostic artifact (a Sykes-White Springs point) and a 5,800±160 B.P. radiocarbon age, identifies a small Middle Archaic component.

Late Archaic projectile point/knives from the general midden and a small pit, Feature 27, suggest a possible low intensity Late Archaic component. The large-shaped fire basin, Feature 30, and many of the stemmed points associated with the assemblage indicate an Alexander component. The fire basin which became a trash pit begun in Alexander times, suggests slightly less transient use of the site during this occupation.

Sand-, limestone-, and bone-tempered ceramics in varying but small amounts in the midden may have been from Early and/or Middle Woodland activity, but could also have been merely minority wares during the major period of habitation, i.e. the Late Woodland/Mississippian.

During the 500 years of the late prehistoric period the site was was still undergoing light, short-term, intermittent use. The site was an upland bluff campsite overlooking the Tombigbee floodplain near a small stream where wild foods were harvested. It may have been a hunting station or wild plant collecting locale visited sporadically. This site represents but a small piece of the Late Woodland and Mississippian settlement pattern mosaic, complementing the arrangement of larger agricultural and ceremonial settlement.

EXCAVATIONS AT THE MUD CREEK SITE (22It622)

The Mud Creek site was located in the Tombigbee River floodplain in northern Itawamba Co., Ms, approximately 11 km (6.9 mi) north of Fulton (Figure 1). The site was approximately 400 m (1,320 ft) south of a tributary stream (Mud Creek) and the Tombigbee River. Only ca. 175 m (574 ft) north of the site was Site 22It606.

The site was approximately 1 m (3.3 ft) above the general elevation of the surrounding floodplain and roughly circular in outline (Figure 25). The surface scatter of artifacts covered an area roughly 85x75 m (23.4x20.6 ft).

Prior to the investigations, the site had been cleared and farmed for approximately 50 years, and the upper 15-20 cm (5.9x7.9 in) has been disturbed by plowing. No potholes were observed; however, the surface probably had been collected. Recent waterway construction road for equipment had been placed on the center of the site. The site was located during Phase I of this project. After exploratory information documented it as a multi-component mound, it was scheduled for testing.

FIELD METHODS

The initial reconnaissance fieldwork included a general surface collection. Subsequently, two 1x1 m (3.3x3.3 ft) test units in the center of the mound (Figure 25) were selected. Block A was excavated to 48 cm (1.6 ft) below surface, but sterile sediment was not reached because heavy machinery had altered the stratigraphy before excavation was completed; Block B was excavated to 58 cm (1.9 ft). Because of the presence of multi-components and the possibility of a stratified site, the site was recommended for testing.

In preparation for testing, the site was mowed and disced in an area approximately 88x84 m (290.4x277.2 ft). Testing was conducted in September and October of 1980 and began with a controlled surface collection of 17% of the site. There were 78 4x4 m (13.2x13.2 ft) which were randomly selected. One 4x4 m (13.2x13.2 ft) unit excavated was located in the center of the site between and tangent to the original 1x1 m (3.3x3.3 ft) units.

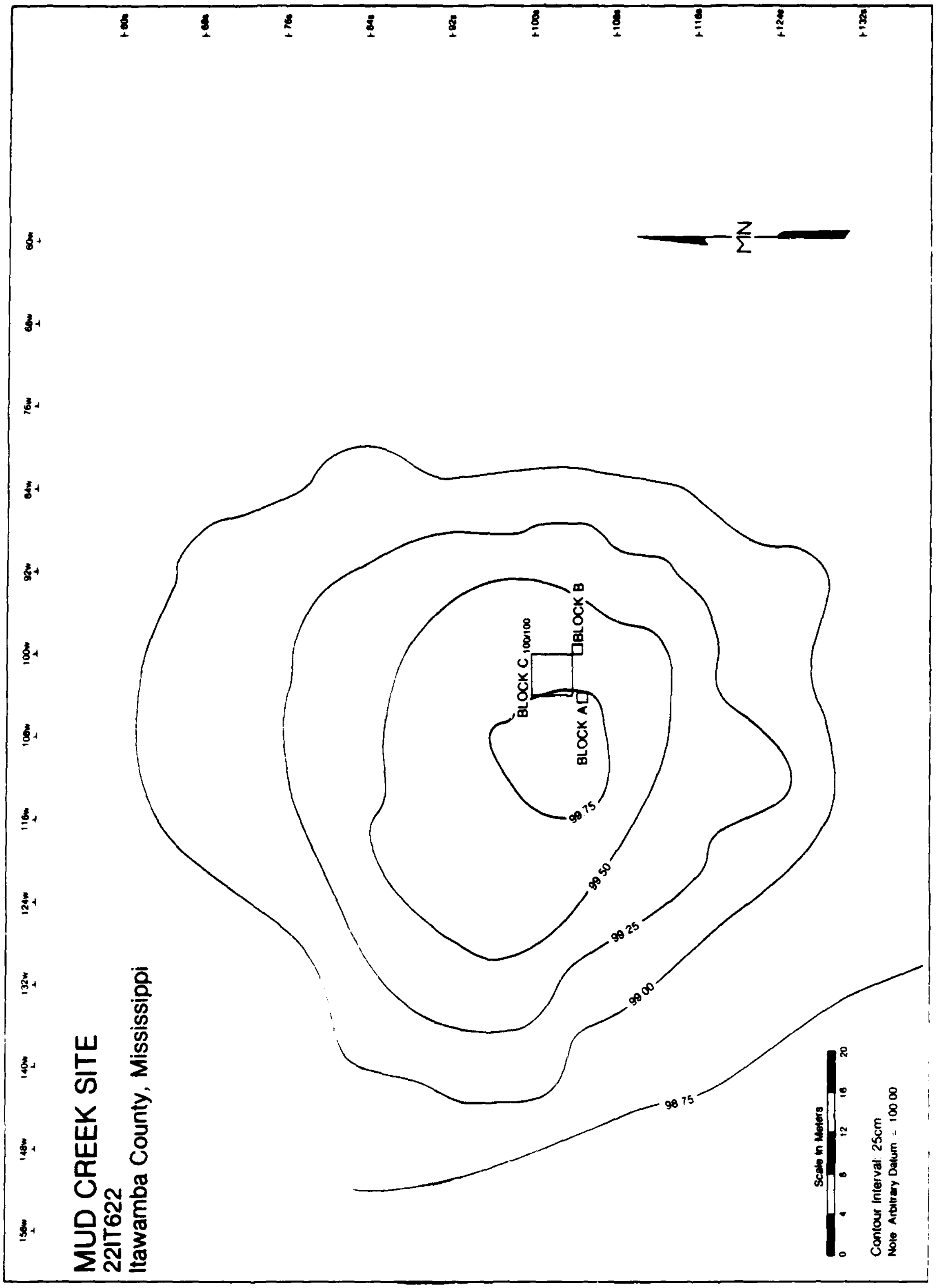


Figure 25 Topographic map and excavation plan, 22It622.

CULTURAL REMAINS

Cultural remains recovered from the Mud Creek site consisted of ceramic and lithic material. Only 41 ceramics were recovered from the site, which is a particularly low figure compared to other sites in the floodplain. The temper types consist of fiber, sand, and grog. Fiber tempering dominated the ceramic assemblage (78.0%), followed by grog (14.6%), and sand (2.4%) (Table 39). The small number of ceramics suggests that the Mud Creek site was only briefly occupied during the post-Archaic. This situation contrasts sharply with other UTV sites.

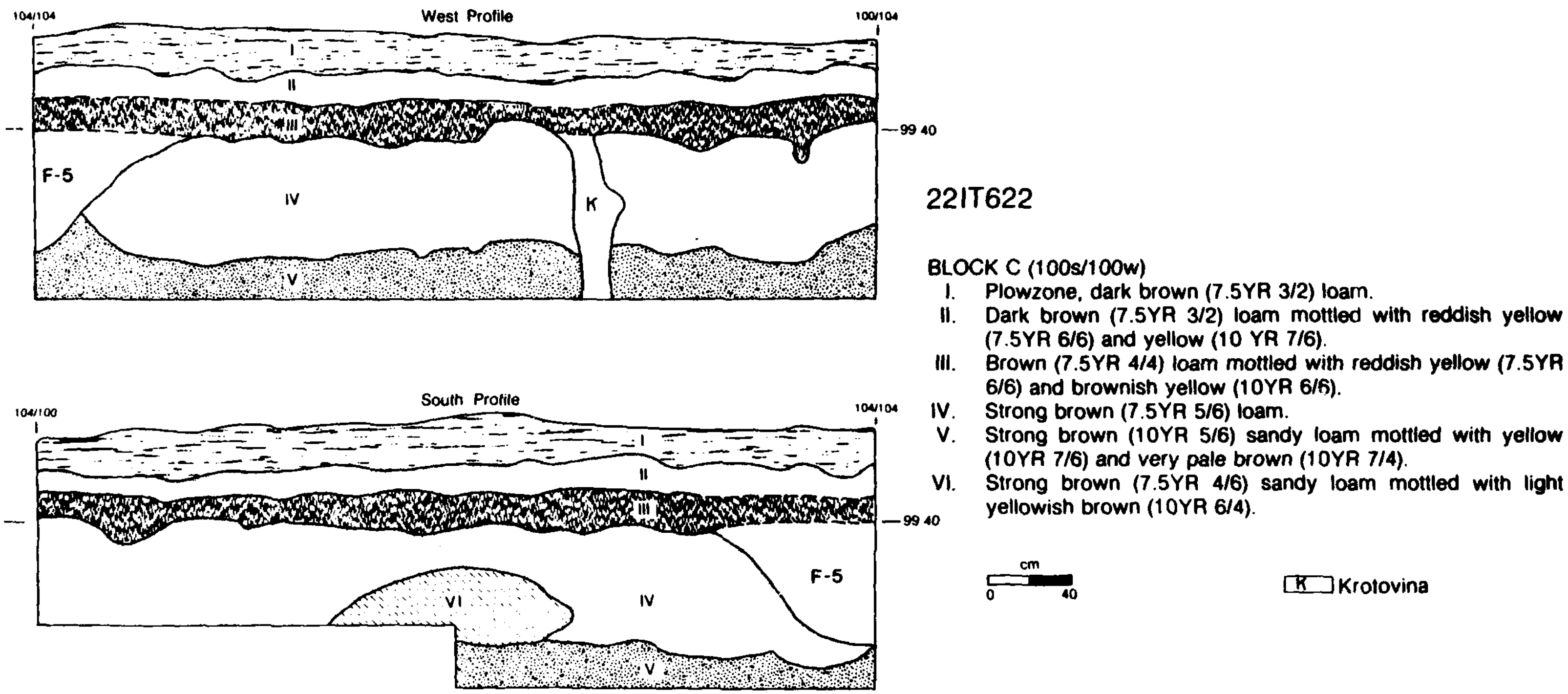
TABLE 39
Ceramic frequencies by temper, 22It622.

Temper	Frequency	Percentage
Grog	6	14.6
Sand	3	2.4
Fiber	32	78.0
Total	41	

A total of 301 chipped stone tools were recovered from the Mud Creek site. The most frequent tool type was "Other Uniface and Bifaces" (48.8%) (Table 40). However, 97.9% of these specimens were unidentifiable fragments of chipped stone tools. Projectile point/knives made up comprising 21.9% of all chipped stone stools and 40.5% of all identifiable chipped stone tools. Preforms (11%), bifaces (8.6%), and scrapers (7.3%) were proportionately low, but relatively even in amount. Drilling tools (2.7%) and cores (1.7%) were the least abundant of the chipped stone tools.

TABLE 40
Chipped stone tool frequencies by type, 22It622.

Type	Frequency	Percentage
Projectile Point/Knives		
Little Bear Creek	10	
Ledbetter/Pickwick	3	
Flint Creek	1	
Wade	1	
Baker's Creek	1	
Crawford Creek	1	
Tombigbee Stemmed	1	
Residual Stemmed	3	
Kirk	4	
Greenbriar	2	
Unidentifiable fragments	39	
Subtotal	66	21.9
Bifaces	26	8.6
Cores	5	1.7
Scrapers	22	7.3
Preforms	33	11.0
Drills, Perforators, etc.	8	2.7
Other Uniface and Biface Tools	141	48.8
Total	301	



22IT622

BLOCK C (100s/100w)

I. Plowzone, dark brown (7.5YR 3/2) loam.
II. Dark brown (7.5YR 3/2) loam mottled with reddish yellow (7.5YR 6/6) and yellow (10 YR 7/6).
III. Brown (7.5YR 4/4) loam mottled with reddish yellow (7.5YR 6/6) and brownish yellow (10YR 6/6).
IV. Strong brown (7.5YR 5/6) loam.
V. Strong brown (10YR 5/6) sandy loam mottled with yellow (10YR 7/6) and very pale brown (10YR 7/4).
VI. Strong brown (7.5YR 4/6) sandy loam mottled with light yellowish brown (10YR 6/4).

Figure 26 Stratigraphic profile of block C, 22It622.

A total of 242 utilized flakes were in this assemblage. The most frequent was 0.5 in (1.3 cm) (57.4%) followed by 0.25 in (.64 cm) size flakes (38.0%). One inch (2.54 cm) flakes (2.1%), chunks (2.1%), and prismatic blades (0.4%) were low in frequency.

Debitage was abundant in this assemblage, totaling 9,030 flakes (Table 41). As in other assemblages, 0.25 in flakes were the most dominant (82.4%).

TABLE 41
Size-grade frequencies of debitage, 22It622.

Size	Frequency	Percentage
1.0 inch	30	0.3
0.5 inch	1,556	17.2
0.25 inch	7,444	82.4
Total	9,030	

Half-inch (1.3 cm) flakes comprised 17.2% of the debitage and only 0.3% were one inch or larger. The distribution of the flakes sizes reflects stone tool maintenance and production at this site.

The tool-to-debitage ratio is 1:30 which is low and likely reflects the manufacture of chipped stone tools at this site during the Archaic stage. The proportion of flake sizes is 1:52:248 which further supports the stone tool production activities.

Only 12 ground stone tools were recovered. While most (12) were fragments of unidentifiable tools, one hammerstone, one steatite sherd, and one sandstone concretion were found.

FEATURES

Only two features were encountered in the testing investigation, i.e. two pits located in Block C. Neither pit contained any diagnostic material, although one did have several chipped stone tools.

STRATIGRAPHY

The stratigraphy indicated that the site was formed by the fluvial deposits. The landform was likely a parallel bar similar to the Poplar, Walnut, and Hickory sites.

Six identifiable strata were recognized in Block C (Figure 26). Five of the six strata were continuous within Block C. Stratum 6 was an extremely compact sediment which was horizontally discontinuous. The upper three strata (50 cm: 1.6 ft) contained the most cultural deposits and were slightly organically enriched, although much less so than in other floodplain mounds. The loamy cultural zone was riddled with krotovinas and root stains, and it exhibited much pedoturbation.

SUMMARY

The Mud Creek site was located in the floodplain of the Tombigbee River Valley and was a small parallel bar formed during flooding episodes. The cultural material recovered indicated that the site had been occupied intermittently from the Early Archaic to Woodland stages, and the materials had been mixed, probably from the intense bioturbation.

Evidence recovered suggest that this site was never occupied intensely. The site probably served as a location for short-term activities. The number of diagnostic projectile point/knives and ceramics recovered suggests that this site was used most frequently during the Late Archaic and middle Gulf Formational.

Although this mound was smaller and lower than the others investigated, it is unusual that it appeared to have had negligible Woodland occupation. Only nine sherds of the Woodland stage were recovered. Compared to the thousands present at other sites, this is remarkable. The absence of shell tempering is also different.

The shallow and mixed midden and low frequency of features mitigated against further investigation.

EXCAVATIONS AT THE SMILAX SITE (22MO675)

The Smilax site was located in Monroe Co., Ms, approximately 3.2 km (2.0 mi) northeast of Aberdeen and 15.6 km (9.7 mi) south of Fulton (Figure 1). This was one of two sites investigated in this project in Monroe County. The site was on a low rise in a plowed field on the edge of the first terrace 400 m (1,320 ft) east of the Tombigbee River channel. The edge of the terrace on which the site was located had been cut off from the remainder by a tributary stream, and the site landform was a low outlier surrounded by wetlands. Vine Creek entered the floodplain and joined the Tombigbee ca. 1,000 m (32.8 ft) to the north of the site. The site area was approximately 90x50 m (297x165 ft) on a small rise of approximately 60 cm (2 ft) on the edge of the terrace outlier overlooking the floodplain. An embankment and ditch of an abandoned 19th-century railroad were present on the eastern edge of the site (Figure 27). The western edge of the site was the terrace edge of the floodplain which dropped 1-1.5 m (3.3-5 ft). The southern boundary was defined by the decrease in surface artifact density. Two other sites, 22Mo676 and 22Mo677, occupy low knolls on the edge of the landform adjacent to the floodplain about 100 m (330 ft) and 200 m (660 ft) to the west-northwest and west-southwest, respectively, of 22Mo675, and cultural material was present in low quantities on the surface between the concentrations of the three sites.

The soil survey indicated that this site was cleared less than 20 years ago (USGS 1961). Prior to this the site area had been covered by forest.

FIELD METHODS

The Smilax site was originally located in Blakeman's (1975:76) survey of the Canal Section of the waterway. It was recommended for additional investigation based on the suspected presence of a Late Archaic component (Blakeman 1975:74). The paucity of information from this cultural period was poor, and the site was tested in Phase I of this project to determine its information potential.

Testing was conducted in Phase I of this project in January and February of 1981 and included a controlled surface collection, mechanical stripping, and test units. The controlled surface collection was a 22% stratified random sample of 4x4 m (13.2x13.2 ft) collection units. Six 2x2 m (3.3x3.3 ft) test pits were excavated (Figure 27). Five were placed randomly, and one test pit (Test Pit 6) was judgmentally placed. Only Test Pits 4 and 6 were excavated into the sterile subsoil. The others were excavated only through the plow zone to obtain a sample and check for features.

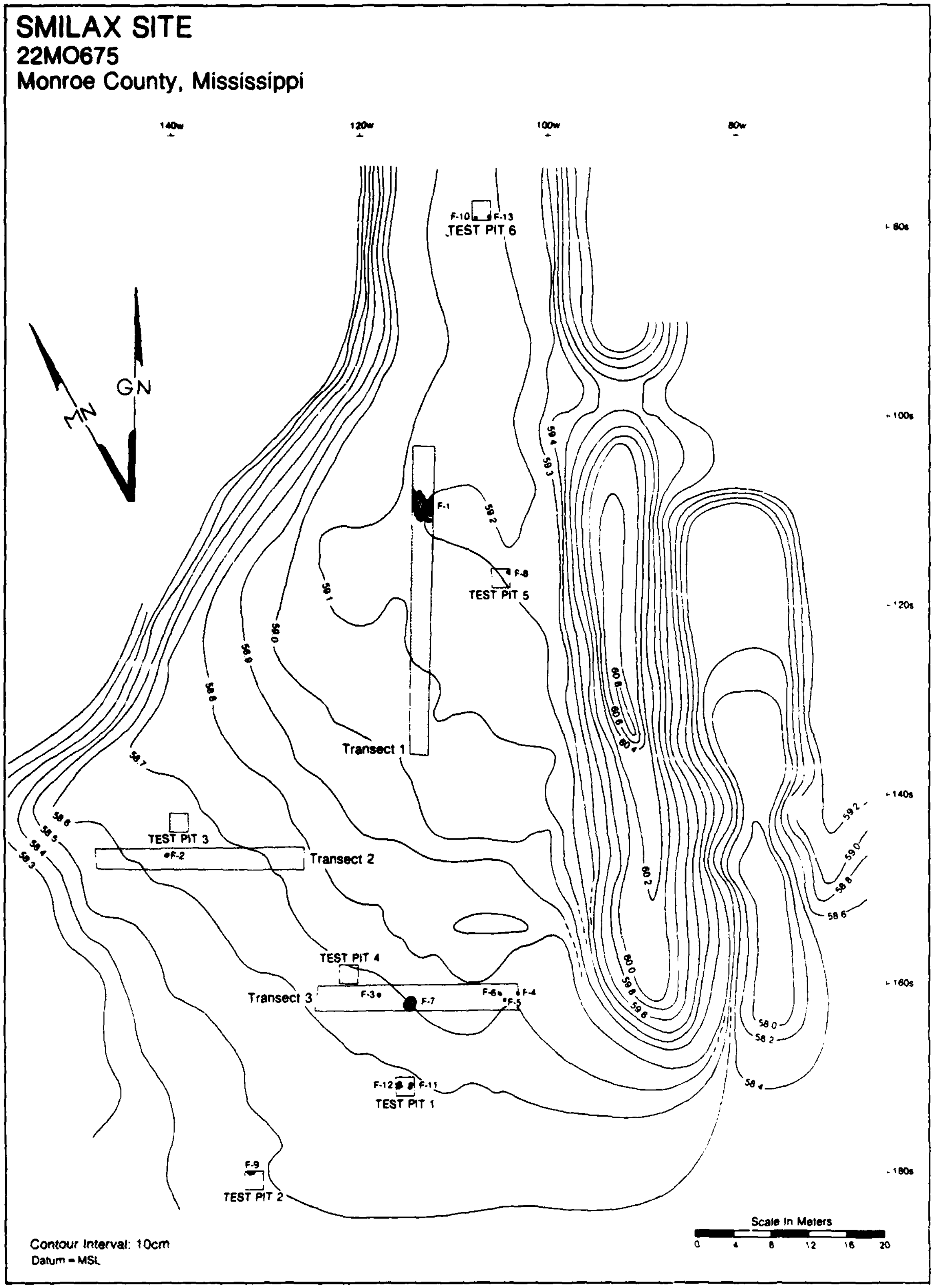


Figure 27 Topographic map and excavation plan, 22Mo675.

Three judgmentally placed 24x2 m (79.2x6.6 ft) mechanically stripped transects were excavated with a small tractor and box-scraper (Figure 27). All potential features were examined and investigated.

CULTURAL REMAINS

Only 78 sherds were recovered from the Smilax site. The assemblage was dominated by sand-tempered sherds (73.1%), followed by 23.1% grog, with only one specimen each of shell/grog-, limestone-, and fiber-tempered sherds (Table 42). All sherds from Units 1-5 were recovered from the plow zone (0-30 cm or 0-11.8 in) below the surface. In Test Unit 6 ceramics also were recovered beneath the plow zone.

TABLE 42

Ceramic frequencies by temper, 22Mo675.

Temper	Frequency	Percentage
Shell-Grog	1	1.3
Grog	18	23.1
Limestone	1	1.3
Sand	57	73.1
Fiber	1	1.3
Total	78	

A total of 24 chipped stone tools were recovered (Table 43). The most frequent category was projectile point/knives (37.5%), including one Late Woodland/Mississippian Triangular, one Gary, two Little Bear Creek, and one Flint Creek. The next most frequent tool type encountered was "Other Uniface and Biface" tools (25%). However, as in all other assemblages, this was made up primarily of unidentifiable fragments (83.3%). The remaining chipped stone tools include drilling tools (12.5%), scrapers (8.4%), preforms (8.4%), bifaces (4.2%), and cores (4.2%).

TABLE 43

Chipped stone tool frequencies by type, 22Mo675.

Type	Frequency	Percentage
Projectile Point/Knives		
Flint Creek	1	
Gary	1	
Late Woodland/Mississippian Triangular	1	
Little Bear Creek	2	
Distal fragment	2	
Medial fragment	1	
Proximal fragment	1	
Subtotal	9	37.5
Bifaces	1	4.2
Preforms	2	8.4
Scrapers	2	8.4
Drills, Perforators, etc.	3	12.5
Cores	1	4.2
Other Uniface and Biface Tools	6	25.0
Total	24	

A total of 31 utilized flakes were recovered. Of these 15 (48.4%) were 0.5 inch (1.3 cm) flakes and 18 (58.1%) were 0.25 inch (.64 cm) in size. The majority (93.5%) were made from Camden chert.

A total of 510 flakes of debitage were recovered (Table 44). Quarter inch flakes were most frequent (88.8%), while 0.5 inch (1.3 cm) flakes composed only 11.2% of the debitage. No flakes greater than 0.5 inch (1.3 cm) were recovered, which likely reflects a lack of initial cobble reduction at the site. Camden cherts made up 93.3% of the debitage, and the remaining 7% of the flakes were composed of heated and unheated Tuscaloosa gravel, blue-green Bangor, Fort Payne, fossiliferous Fort Payne and Pickwick cherts, quartzite, ferruginous sandstone, and unidentified raw materials. Ground stone tools were few and limited to one unidentifiable ground stone tool and one ground stone flake.

TABLE 44
Size-grade frequencies of debitage, 22Mo675.

Size	Frequency	Percentage
0.5 inch	57	11.2
0.25 inch	453	88.8
Total	510	

The tool-to-debitage ratio is 1:22, which is relatively high. However, the flake size grades contained none greater than 0.5 inch (1.3 cm) and a ratio of 1:8 for the 0.5-0.25 inch (1.3-0.64 cm) sizes.

No ground stone artifacts were recovered from this site. This is the only site in the project which produced no such tools.

Historic material included two brass shotgun shell bases, one fragment of slag/cinder, one fragment of unidentifiable clear glass, and one aluminum can. All were contained in the plow zone.

FEATURES

No cultural features were documented in the testing of the Smilax site. All suspected features identified in Figure 27 were natural in origin.

STRATIGRAPHY

Three major strata were documented at 22Mo675 (Figure 28). The strata consisted primarily of a plow zone 10-20 cm (3.9-7.8 in) thick which was part of a moderately dark organically enriched stratum 5-15 cm (2-5.9 in) thick. This had mostly been disturbed by plowing or cultivation. The basal stratum a compact yellow-brown silty loam of indeterminate depth. It was culturally sterile.

SUMMARY

The Smilax site was located on a terrace remnant, surrounded by the wet floodplain of the Tombigbee River, containing many other sites. Testing investigations documented that the site had been occupied during the Historic (Euro-American), Late Woodland, Middle Woodland/Late Gulf Formational, and Late Gulf Formational periods. The position of all diagnostic artifacts recovered from test units located however were confined to the plow zone. It appears that cultivation apparently had destroyed the vertical and horizontal integrity of the cultural components.

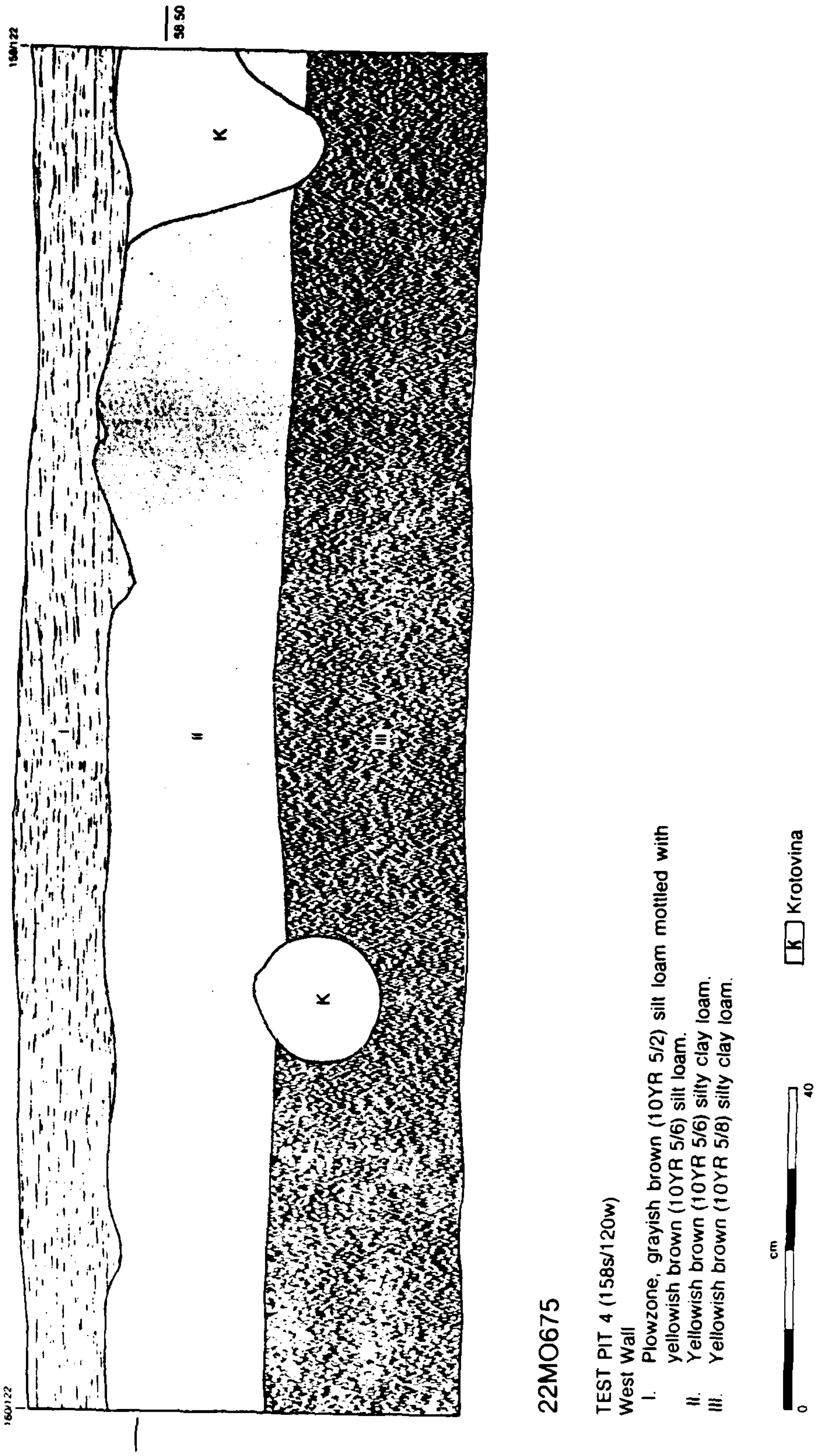


Figure 28 Stratigraphic profile, 22Mo675.

One pattern was seen in the lithic debitage which was concentrated in Test Pits 5 and 1. Diagnostic artifacts recovered from these units were confined to the plow zone and range from Late Archaic to Late Woodland. Chipped stone tools were concentrated in Test Pit 6. All diagnostics, however, were confined to the plow zone indicating that this uncultivated wooded area.

Of the diagnostic material recovered, more was from the Late Archaic through Middle Woodland periods, suggesting more use during this time. However, this site was never intensely used during any period and can be considered to have been the scene of very limited activities.

EXCAVATIONS AT THE DOGWOOD MOUND SITE (22Mo531)

The Dogwood Mound was located in Monroe Co., Ms, approximately 8.3 km (5.4 mi) northeast of Aberdeen (Figure 1). The site lies approximately 520 m (1,706 ft) east of the present channel of the Tombigbee River and on the edge of the first terrace. The Dogwood Mound was a conical earthwork measuring approximately 17 m (55.8 ft) in diameter and 1.85 m (6.1 ft) in height (Figure 29). A pothole was in the center of the mound approximately 3.75x4 m (12x13.1 ft) in size. The mound was situated in an old field, which had been planted in pines. Second growth oak and hickory grew on the earthwork and within about 5 m (16.5 ft) of its perimeter. The understory consisted of dogwood, briars, and climbing vines.

The terrace edge was approximately 40 m (132 ft) west of the mound, and it marked the boundary of the floodplain which supports a rich hardwood forest. A relic channel of the Tombigbee lay near the site in the floodplain which contained a small stream. The terrace on which the Dogwood Mound was situated was broad and level.

FIELD METHODS

The site was first located and recorded during the first survey of the waterway (Lewis and Caldwell 1972:18,111) and was investigated further by Adkinson (1978:114) and Blakeman (1976:75) who identified it as a probable Miller I period burial mound.

Blakeman (1976:75) hypothesized that the earthwork was a "Miller I Period burial mound" and noted that "as such this site joins a relatively elite group of sites in northeast Mississippi including the Pharr Mounds and Bynum Mounds." Blakeman's recommendations were supported by Atkinson (1978:114) when he expressed the concern due to the rarity of such mounds in the Upper Tombigbee Valley and the threat of vandalism.

The site was subsequently tested in Phase I of this project from February to March of 1981 to assess the cultural affiliation of the mound and to evaluate its integrity. A large recent pothole, dug by relic collectors, intruded into the top of the mound (Figure 29).

Testing investigations included a hand-excavated trench into the mound and several deep auger borings. Two sides of the earthwork were cross-sectioned with a series of 1x2 m (3.3x6.6 ft) units separated by 10 cm (3.9 in) balks (Figure 29). All units excavated in the mound, except one, were dug to the subsoil contact. Soil texture, color, and structure were used to separate the construction fill from the sub-mound soil. Soil characteristics and cultural phenomena were noted or mapped during level excavation.

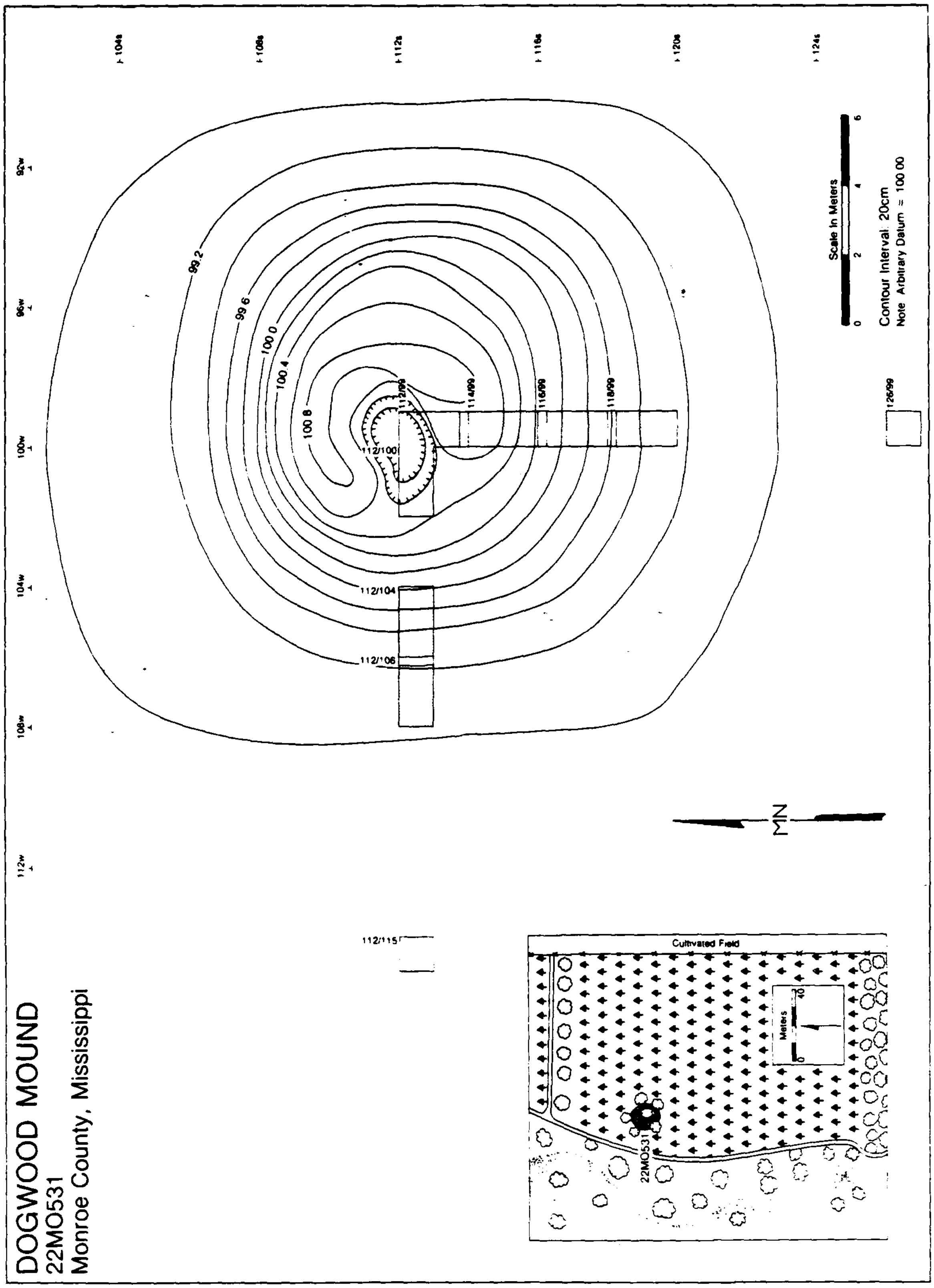


Figure 29 Topographic map and excavation plan, 22Mo531.

CULTURAL REMAINS

Prehistoric cultural debris was found scattered throughout the fill of the earthwork. Ceramics and lithics indicate that the earth used to construct the mound was removed from an area which contained cultural material. The silt loam character of the fill suggests that the dirt was quarried nearby. No borrow area was observed, however. Historic land use and periodic flooding of the locale apparently obliterated any traces of such a borrow pit.

Ceramics provided the most definitive clue to the cultural affiliation of the mound. The entire assemblage consisted of Middle Woodland limestone- (3.3%) or sand-tempered (96.7%) specimens (Table 45). The presence of Furr's Cord Marked, Saltillo Fabric Marked, Plain sand-tempered sherds, and Mulberry Creek Plain indicated a Middle to Late Miller I context (ca. A.D. 1 - 300) (Jenkins 1979:257-259). Further, the number of Furr's Cord-Marked sherds (9) in comparison to those of Saltillo Fabric Marked (33) hints that the former constitutes a major type in spite of being outnumbered by the latter. If that is the case, the ceramics probably represent a Late Miller I occupation, and the mound was probably constructed at ca. A.D. 200 - 300 (Jenkins 1979:258-259).

TABLE 45
Ceramic frequencies by temper, 22Mo531.

Type	Frequency	Percentage
Limestone	10	3.3
Sand	296	96.7
Total	306	

A total of 37 chipped stone implements were recovered (Table 46). Identifiable projectile point/knives included only one Little Bear Creek and two Residual Stemmed types. The most frequent category was "Other Uniface and Biface" tools, but 88.9% were fragments of unidentified tools. Atypically, cores followed projectile point/knives in frequency (13.5%) followed by scrapers (10.8%), preforms (5.4%), and bifaces (2.7%). Utilized flakes were the most frequent tool type (n=119), and 51.3% were 0.5 inch (1.3 cm) in size. Six ground stone items, including two hammerstones, a muller, one piece of ground hematite, and two unidentified fragments, were found.

TABLE 46
Chipped stone tool frequencies by type, 22Mo531.

Type	Frequency	Percentage
Projectile Point/Knives		
Little Bear Creek	1	
Residual Stemmed	2	
Distal fragment	2	
Medial fragment	2	
Subtotal	7	18.9
Cores	5	13.5
Preforms	2	5.4
Bifaces	1	2.7
Scrapers	4	10.8
Other Uniface and Biface Tools	18	48.6
Total	37	

Debitage flakes were quite numerous (n=3,086). As seen in Table 47, 83.7% were 0.25 inch (.64 cm) in size. Half inch (1.3 cm) comprised only 16.2%, and flakes greater than one inch (2.54 cm) accounted for only (0.1%) of the total. The primary raw material was Camden chert (94.1%) with Fort Payne chert making up most of the remainder of the raw materials.

TABLE 47
Size-grade frequencies of debitage, 22Mo531.

Type	Frequency	Percentage
1.0 inch	4	0.1
0.5 inch	499	16.2
0.25 inch	2,583	83.7
Total	3,086	

The tool-to-debitage ratio in the fill of this mound is 1:87 and is relatively low. The proportion of the flake sizes is 1:124:645, the lowest of all sites investigated.

Historic artifacts included 15 6d common cut nails and 19 seed beads. All but three of these items were recovered in association with a burial in the mound. The remaining specimens were recovered from the pothole in the mound.

Testing demonstrated that the mound had been utilized as an historic cemetery, probably during the 19th century. Excavation documented at least two interments. The south edge of the grave shaft of the southern historic burial was clearly discernible in the profile and extended from the root mat within a few centimeters of the surface to a depth of about 6 ft (1.83 m). The recent pothole destroyed a major portion of the center of the earthwork. It was originally 3.5x4 m (11.4x13.1 ft) wide at the top and tapered to 2x1.5 m (6.6x5 ft) at the bottom and was 1.6 m (5.2 ft) deep. This pothole destroyed at least one historic burial as well as the northern margin of the grave of Burial 1. The impact of the vandal's activities on any prehistoric interments that may have lain at the base center of the earthwork could not be determined.

FEATURES

Three features were documented during the Dogwood Mound testing project. Feature 1 appeared to be a dark brown load of midden used in construction. It was irregular in plan and profile, 90 cm (2.9 ft) below the surface, 51x43 cm (1.7x1.4 ft) wide, and 25 cm (9.8 in) thick. Artifacts in it included aboriginal pottery and a few grams of introduced rock.

Feature 2 was 150 cm (4.9 ft) below the surface and was a deposit of red ocher. It was oval in shape with slightly tapering sides with a basin-shaped cross-section measuring 14.5x17.5x12 cm (5.7x6.9x4.7 in) thick. This feature was probably an intentional deposit in the mound fill.

One burial was also located in the mound. It was in the center of the mound 179 cm (5.9 ft) below the surface. Only the western end of a poorly preserved coffin and the upper remains of a Caucasian female, whose age at death was estimated as 50± years, were exposed. The major portion of the interment extended eastward into an unexcavated section of the site. The burial coffin was manufactured with cut common nails. The use of these nails suggests that the coffin was manufactured from one-inch (2.54 cm) planks. The vertical orientation of nails along the southern and western sections of the coffin suggests that the sides were set on the bottom and nailed from beneath. The width of the coffin probably ranged from 30.5-40.6 cm (12.16 m); the height and depth of the container was probably more than 30.5 cm (1 ft).

A series of eight green seed beads, ca. 2 mm in diameter, and 11 black seed beads, ca. 3 mm diameter, were found in the thoracic area of the burial. These beads lay in a position which suggested a single strand arrangement which was perhaps appliqued to a garment. No other grave goods were recovered.

The cranium and mandible of the interment were examined in the field by the physical anthropological consultant. His observations documented that the individual was of Caucasian extraction and a female. The age estimation was based on the thinness of the parietals, maturity of the cranial sutures (closed on both the interior and exterior surfaces), and teeth wear. The condition of the teeth would argue for a lower age, but balanced with the suture closings and parietal thinning suggested the older age.

All teeth present were in relatively good condition with no developmental defects or evidence of physical trauma. One cavity was found in the upper right second molar and no developmental defects, or evidence of physical trauma. The first molars on both the left and right sides of the mandible and maxilla were absent. All first molars were lost pre-mortem as indicated by the alveolar resorption and remodeling which had occurred.

A circular penetration of approximately 5.6 mm of the left parietal immediately posterior to the coronal suture was interesting and possibly significant. The penetration was quite close to the bregma and resembled a wound, possibly caused by a .22 caliber bullet. It was impossible to determine whether this wound was the proximate cause of death. Without doubt this particular wound did not result in the immediate death of the individual. The inner table of the parietal was not shattered. Examination of the interior of the cranium showed that repair and rebuilding of the inner table had proceeded for several months prior to death. The surfaces of the inner cranium did not give an indication of markings left by a bullet either as an exit wound or as ricochet trails. Although the area surrounding the cranium was searched, no bullet was found. From the apparent angle of the wound (if indeed it was a bullet) an exit through the foramen magnum is not inconceivable.

Other pathologies included considerable infectious disturbance occurring in the mastoids. Even with some remodeling the mastoids displayed marked indications of mastoiditis. The infection of the mastoids did not appear to have been active at the time of death. The superior surface of both orbits displayed some porosities of an appearance similar to cribra orbitalia. The left orbit was the more severely affected. Although the causes of cribra orbitalia are not clearly established there is some evidence suggesting that depletion and/or insufficiency of iron available to the organism may produce lesions of this type. Such iron deficient associations with cribra orbitalia have been noted in tropical areas where parasitic infection is quite common. No hyperostosis spongiosa orbitae was noted in either facial or cranial bones. Both the atlas and axis were completely normal in appearance, showing no pathologies or degenerative changes.

To summarize, Burial 1 was a Caucasian female approximately 50 years old who was interred, presumably, in an extended position in a burial container assumed to be a simple rectangular coffin. A mid-nineteenth century date was estimated for the burial. Further, the association of the historic Dogwood Mound grave plot and an historic farmstead site within 300 m (990 ft) conforms with an expected settlement pattern of rural residence units.

Although Burial 1 was the only interment formally defined, cranial remains of a second individual and 6d nails were recovered from the fill of the vandal's pit just to the north of Feature 3. This indicates that the Dogwood Mound contained at least two historic interments.

All artifacts except the beads and nails associated with Feature 3, Burial 1 were recovered from the mound fill and what may be a buried A horizon at the base on the mound on the original land surface. No distribution patterns within the mound were detected. Material recovered from the off-mound units indicate that prehistoric occupation debris was confined to the plow zone.

STRATIGRAPHY

The silt-loam soil in the immediate area was documented in the two test pits excavated approximately 5 m (16.4 ft) from the south and west edges of the mound. This soil was encountered beneath the mound and served to identify the base of the earthwork.

Five stratigraphic zones were defined in the Dogwood Mound (Figure 30). The stratigraphy of the mound fill indicated that the earthwork probably represented a single construction episode. Stratum I and II were apparently the result of weathering of the mound's upper surface since construction. Stratum III accounted for the major volume of the earthwork and probably represented a single depositional phase. Stratum IV appeared to have been the buried A horizon, or a redeposited A horizon. It is postulated that the absence of this stratum in the western section of the earthwork can be accounted for by its lack of distinguishing characteristics in this section of the site or by its prehistoric removal.

SUMMARY

Test excavations at Dogwood Mound revealed no aboriginal interments or cremations. Although inhumations were expected at the base center of the mound, testing revealed only two historic intrusions in this location. The U.S. Army Corps of Engineers ordered excavation to cease after the *in situ* Euro-American burial that lay at the approximate center of the earthwork was discovered. No evidence of prehistoric burials was encountered 1 m (3.3 m) west or 2 m (6.6 m) to the south.

Despite the lack of aboriginal interments, the material contents of the fill indicate that the earthwork was constructed during the Middle Woodland period. A ceramic complex, containing Saltillo Fabric Marked, Furr's Cord Marked, Plain sand-tempered sherds, and Mulberry Creek Plain, argues that the mound was probably constructed during the latter part of the Miller I phase or ca. A.D. 1-300 and quite possibly during the Late Miller I subphase (ca. A.D. 200-300).

The stratigraphy of the earthwork suggested that the mound was constructed as a single unit. Differentiation of stratigraphic zones was considered the result of post depositional weathering and possible burial of an A horizon. A historic grave, inferred to date to the 19th century, crosscut or intruded into all but the base strata of the site. Although it might be suggested that the earthwork was an artifact of the historic period for use as a cemetery plot, the crosscutting and truncation of stratigraphic zones within the earthwork negate this possibility. Based on the available evidence, albeit circumstantial, there is little doubt that the mound was a prehistoric feature, most probably associated with mortuary practices.

The use of aboriginal earthworks for Euro-American cemeteries was in keeping with the historic settlement pattern practice of selecting prominent topographic features for the location of graveyards. The site of the Dogwood Mound historic grave plot and the location of a farmstead site approximately

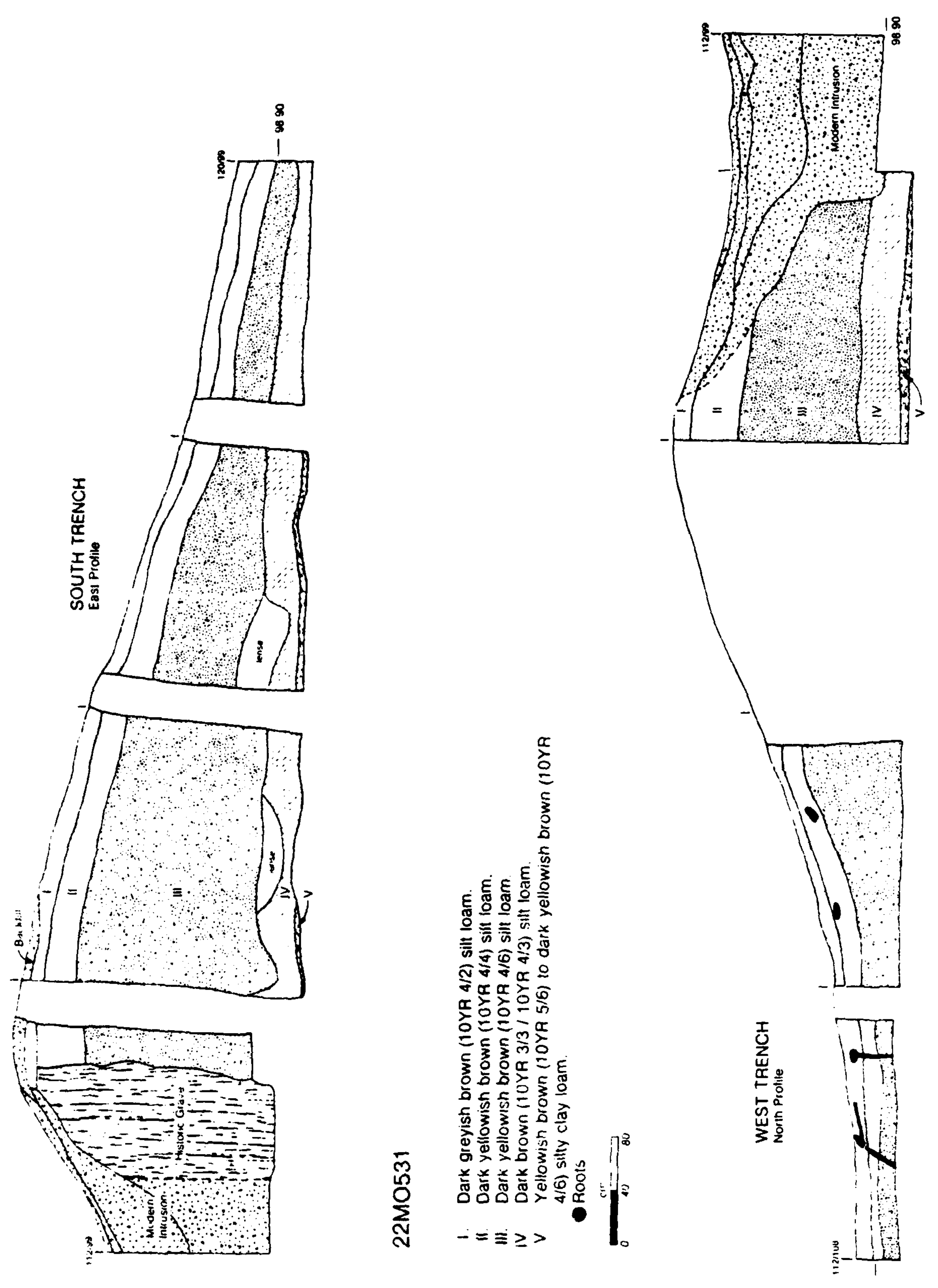


Figure 30 Stratigraphic profile, 22Mo531.

230 m (759 ft) to the east, however, reflect a locational pattern common to rural households of the Southern Piedmont during the 18th and 19th centuries.

The Euro-American interment at the Dogwood Mound requires one of two actions. The site can either be preserved and protected in perpetuity, or the historic interment(s) can be moved and reburied which would necessitate mitigating the impact of this action on the prehistoric resources of the site.

SUMMARY OF EXCAVATIONS

Of the 11 sites investigated in this project, four were excavated only, four were tested and excavated, and three were tested only. The sites were located on and adjacent to the floodplain of the Upper Tombigbee Valley. In situ stratified deposits of the Archaic stage were encountered and excavated at six of the sites. In addition, one Late Gulf Formational and one Late Woodland/Mississippian component was excavated. Four of the sites (Poplar, Walnut, Ilex, and Hickory) were midden mounds which were islands of well-drained loam in the wet floodplain. Of these the Walnut and Poplar sites were the most intensely occupied and contained the most material and features. The Beech and Oak sites (22It623 and 22It624) were in the floodplain, but not as intensely occupied as the others.

The information recovered from these sites will be more integrated in Chapter X of this report.

CHAPTER VI SOILS AND GEOMORPHOLOGY STUDIES

INTRODUCTION

Although archaeological studies were an important part of the investigations, other disciplines, especially soils science, produced a great deal of useful information. In this chapter, the soil studies conducted in this project, especially soil chemistry and morphology, are reported and interpreted. These soil studies have contributed markedly to the understanding of midden mound morphogenesis, past landscape stability, intensity of site use by human groups, and consequent effects on the soil profile. Data acquired were largely original, and they supported more realistic interpretations about both the nature of past human behavior at these sites, and they contributed to an understanding of extant landforms.

The soil studies conducted as part of these investigations identified and described paleosols, anthrosols, and soil development processes at five floodplain and one upland site. Since much of the soil science data and discussion in this chapter are probably outside the ken of many archaeologists, the editor has included a section at the end of this chapter which describes and interprets the soil studies especially for them.

The goals and objectives of the soil and geomorphological studies performed in this project were as follows:

1. To investigate and describe the pedogenic/geomorphic relationship of representative sites in their natural setting.

2. To characterize the physical, morphological, chemical, and mineralogical soil parameters of selected representative sites.

3. To characterize the organic-stained epipedons of typical sites.

4. To describe and quantify the paleosols at selected sites.

METHODOLOGY

Preliminary soil examinations of sites and adjacent areas were made using positional transects and soil auger observations to depths of 2 m (6.6 ft). The morphological examinations included geomorphic position, soil color, texture, structure, consistency, horizonation, boundaries, coarse fragment contents, and hydrological characteristics.

Detailed soil examinations of the sites were made in excavation units and stratigraphic backhoe trenches. The soils were described and sampled using the standard method (USDA Soil Survey Staff 1951). Samples were sealed in plastic bags for subsequent analyses.

Soil samples were air dried, crushed with a wooden rolling pin under gentle pressure, and sieved through a 2 mm sieve for laboratory analyses. Particle size distribution was determined by the hydrometer method and sieving (Day 1965). Soil organic carbon was determined by wet combustion (Allison 1935). Extractable acidity was determined by the barium chloride-triethanolamine method (Peech 1965). Exchangeable aluminum was determined by potassium chloride extraction following the procedure of Yuan (1959). Free iron oxides were determined by sodium-dithionite extraction and potassium dichromate titration (USDA Soil Conservation Service 1972). Exchangeable cations were extracted with neutral 1N NH4OAC and determined by atomic adsorption spectrophotometry. Soil pH was measured in water using a 1:1 soil-to-liquid ratio.

Nitrogen was determined by the Kjeldahl method (Bremner 1960) using soil ground to pass through a 60-mesh sieve. Citric acid-soluble phosphorus was extracted with 1% citric acid after shaking thirty minutes and determined by the molybdovanate method (AOAC 1975) using a Bausch and Lomb Spectronic 21 spectrophotometer. Phosphorus fractionation on selected samples was determined by modification of the Chang and Jackson procedure (Peterson and Corey 1966; Meixner and Singer 1985). Determination of humic/fulvic acid compounds of selected samples was determined by color ratio at 400 and 600 nm using a Spectronic 21 spectrophotometer (Tan and Giddens 1972).

Clay fractions were separated by centrifugal sedimentation. They were analyzed by X-ray diffraction (Jackson 1956) with a Norelco Geiger counter spectrophotometer using Cu Ka radiation and a nickel filter. Mineral type and content were estimated from the basal spacings and X-ray peak intensity. Differential thermal analysis was conducted on selected samples using magnesium-saturated samples equilibrated to 56% relative humidity and a Deltatherm DTA instrument. Microscopic examinations were made of selected soil peds using reflected light microscopy to 150 power.

Soil samples were described and collected from profiles considered representative of the site after observation of the site and the adjacent off-site soilscape. Geomorphic surfaces were studied by field transects between sites using a soil auger for subsurface investigations.

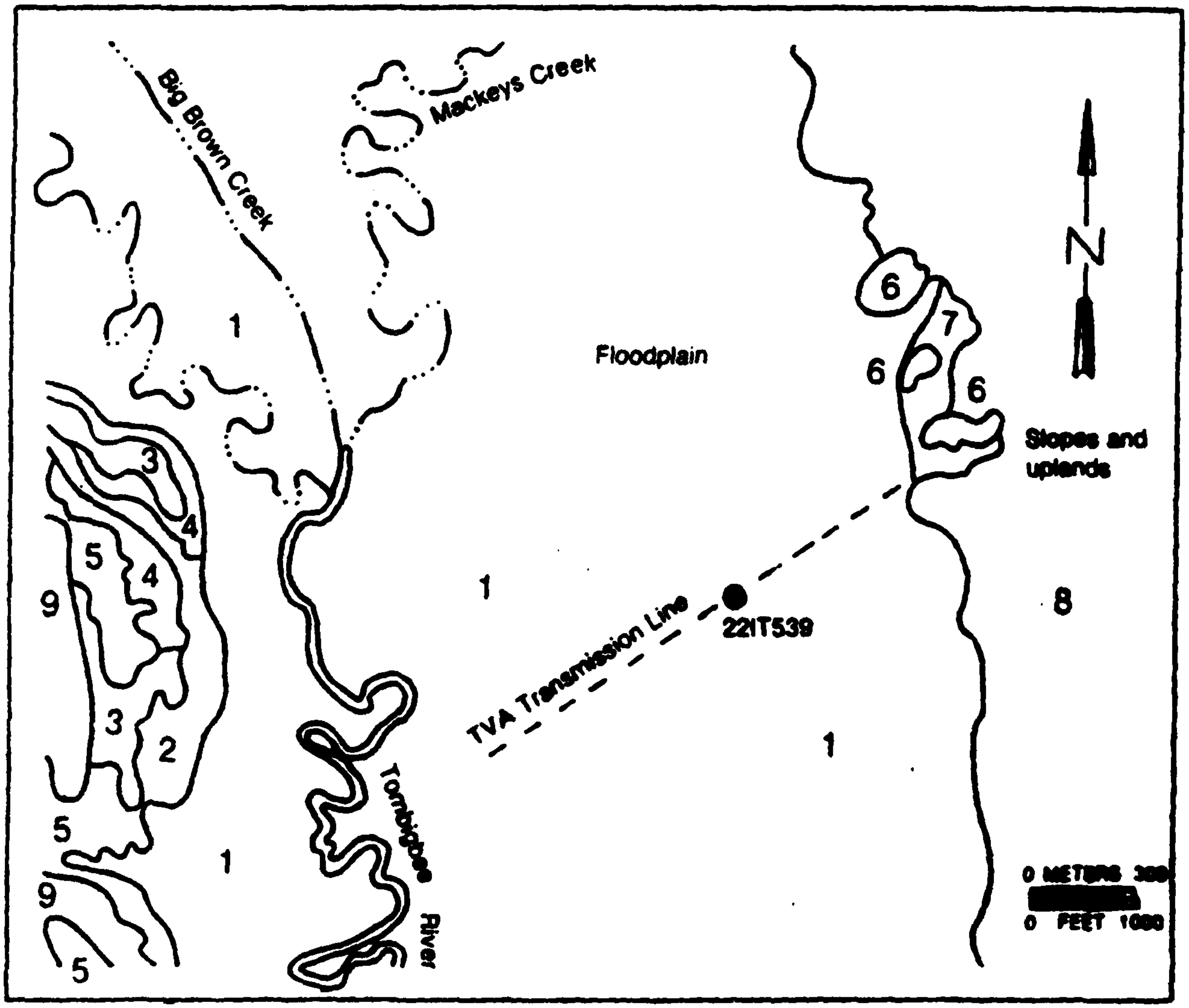
The information recovered from individual site investigations will be presented here from five selected-as-representative sites. The detailed information will be presented for each site with an integrative summary following.

THE WALNUT SITE (22It539)

The site was in the eastern part of the Tombigbee River floodplain about 750 m (2,475 ft) west of the eastern valley wall, and was a prominent topographic feature elevated approximately 1-1.5 m (3.3-5 ft) above the surrounding floodplain (Figures 1 and 6). The site had slopes of 2-5% in contrast to slopes of 0-2% in the adjacent floodplain. Lower-laying parts of the site were subject to winter and spring flooding, which regularly scours and fills the floodplain creating microrelief.

The elevation appeared to be a natural topographic feature resulting from fluvial deposition. Small sloughs partially surrounded the site, and their silty bottom sediments indicate an aggrading status. The coarse texture of the sandy loam soils in the site suggest higher energy depositional events.

The steep valley walls bounding the floodplain are composed of mature, well-developed soils with thin ochric epipedons and well-developed illuviated argillic horizons (Bt) and eluviated E horizons. Smithdale soils (Figure 31) dominate the eastern valley wall. These soils are deep, well drained, and permeable, with red subsoils. They formed in thick beds of loamy materials on side slopes ranging to 40%. The argillic horizons have subangular blocky structure and oriented clay skins on ped faces. Soils of the western valley wall are less steep, and the Ora and Savannah soils contain dense, firm fragipan horizons in the argillic horizons. The Mathison soils of the western valley wall have relatively high silt contents. The upland soils are very strongly acid, highly weathered siliceous Ultisols (Table 48) with low base saturation levels.



SOIL LEGEND

SYMBOL	NAME
1	Kirkville-Mantachie association
2	Mathiston silt loam
3	Ora fine sandy loam, 2 to 5 percent slopes, eroded
4	Ora fine sandy loam, 8 to 12 percent slopes, eroded
5	Savannah loam, 2 to 5 percent slopes
6	Smithdale fine sandy loam, 5 to 8 percent slopes, eroded
7	Smithdale fine sandy loam, 8 to 17 percent slopes
8	Smithdale association, hilly
9	Savannah loam, 0 to 2 percent slopes

Figure 31 Soils in the vicinity of 22It539.

TABLE 48
Classification of soils from the site and vicinity, 22It539.

Soil Series	Classification
Kirkville	coarse-loamy, siliceous, thermic Fluvaquentic Dystrochrepts
Mantachie	fine-loamy, siliceous, acid, thermic Aeric Fluvaquents
Mathiston	fine-silty, siliceous, acid, thermic Flavaquents
Ora	fine-loamy, siliceous, thermic Typic Fraguidults
Savannah	fine-loamy, siliceous, thermic Typic Fraguidults
Smithdale	fine-loamy, siliceous, thermic Typic Paleudults

Kirkville and Mantachie soils comprise the floodplain bounding the site (Figure 31). These soils are Dystrochrepts and Fluvaquents with minimal soil development (Table 48). They typically had brown and yellowish brown surfaces and gray or light gray subsurface horizons (Table 49). Textures ranged from sandy loam to silty clay loam with occasional loamy sand, which reflects the textural stratification. The floodplain soils exhibited little profile development and had some cambic Bw horizons. They were strongly acid.

The culturally altered soils of the site developed in loamy, fluvial, siliceous sediments. These soils were readily distinguished by very thick, humus-rich, dark reddish brown epipedons (surface horizons), which were due to prolonged cultural activity and habitation. The past occupation of the site has drastically altered normal pedogenic features of color, structure, consistency, horizonation, organic matter content, and certain chemical parameters. The soil comprising the site differed greatly from adjacent floodplain soils and was readily distinguished.

Profuse populations of earthworms, crawfish, rodents, and other diverse microfauna and microflora thrived in the organic-rich mound, which was elevated above the adjacent floodplain and seasonal wetness. Pedoturbation has tended to mix the upper meter (3.3 ft) of soil and affected normal pedogenic expression. Horizonation tended to be marked by intense dark-colored humic staining of the skeletal matrix.

TABLE 49
Munsell color of selected horizons of representative soils in the floodplain adjacent to Site 22It539.

Sample	Depth (cm)	Munsell Color (moist)
Terrace east of the site above the floodplain	15 - 30	Yellowish brown (10YR5/4)
	30 - 83	Brownish yellow (10YR8/8)
Middle of the floodplain east of the site	0 - 30	Brown (10YR5/3)
	50 - 75	Gray (10YR8/1)
	75 - 105	Gray (10YR8/1)
Floodplain 75 m east of the site	30 - 60	Light brownish gray (10YR8/2)
	75 - 100	Light gray (10YR7/2)
Floodplain 20 m east of the site	25 - 50	Brown (10YR5/3)
	85 - 125	Gray (10YR6/1)
Floodplain 75 m west of the site	5 - 30	Dark gray (10YR4/1)
	62 - 88	Grayish brown (10YR5/2)

TABLE 49
Munsell color of selected horizons of representative soils in the floodplain adjacent to Site 22It539 (continued).

Sample	Depth (cm)	Munsell Color (moist)
Floodplain 120 m	15 - 37	Dark brown (10YR4/3)
west of the site	40 - 50	Dark yellowish brown (10YR4/4)
Floodplain 40 m	25 - 50	Gray (10YR5/1)
south of the site	55 - 85	Dark gray (10YR4/1)
	90 - 125	Gray (10YR5/1)
Floodplain 100 m	5 - 37	Grayish brown (10YR5/2)
south of the site	100 - 125	Gray (10YR5/1)
Floodplain 75 m	15 - 37	Gray (10YR8/1)
north of the site	87 - 112	Light gray (10YR7/1)

PHYSICAL DESCRIPTION

The mound soil was dark reddish brown and reddish brown with Munsell hues of 5YR in the upper 1.8 m (5.9 ft) (Table 50), which differs markedly from the adjacent floodplain soil which have hues of 10YR (Table 51). The site epipedon had a Munsell color value that shifted one unit with wetting and drying. The dark reddish brown epipedon had a distinct "greasy" feel when rubbed between the fingers. Individual quartz grains had a continuous coating of humic stain. The thick, dark-colored epipedon graded into brighter colored subsoil materials at depths below 1.3-1.8 m (4.3-5.9 ft). The subsoil had dominant colors in the 10YR hue. Humic staining commonly extended into the upper part of the brighter colored subsoil and coated vertical surfaces of ped faces. Typically, below the dark-colored epipedon and immediately above the brighter colored paleosol, the humic materials formed distinct horizontal bands or lamellae, where vertical water flow had been retarded by the less permeable underlying paleosol.

TABLE 50
Pedon description of representative profile, 22It539.

Depth (cm)	Description (moist colors)
0-15	Dark reddish brown (5YR3/3) sandy loam; moderate fine and medium granular structure; slightly firm in place, very friable when disturbed; many fine and medium roots; few small black (10YR2/0) charcoal fragments; greasy when rubbed; medium acid; gradual wavy boundary.
15-37	Dark reddish brown (5YR3/3) sandy loam; moderate fine granular structure; friable; many fine and common medium roots; few small charcoal fragments; numerous krotovina and worm casts; common small and medium gray (10YR3/1) and dark gray (10YR4/1) potsherd; greasy when rubbed; medium acid; gradual wavy boundary.
37-60	Dark reddish brown (5YR3/3) loam; weak fine granular structure; friable when disturbed; common fine and few medium roots; few small charcoal fragments; numerous krotovina and worm casts; greasy when rubbed; strongly acid; clear smooth boundary.

TABLE 50
Pedon description of representative profile, 22It539 (continued).

Depth	Description
(cm)	(moist colors)
60-100	Dark reddish brown (5YR3/2) sandy loam with few medium faint very dark brown (10YR2/2) mottles; weak fine granular structure; friable when disturbed; occasional laminae of strong brown (7.5YR5/8) loam in lower part of horizon; occasional mottled dusky red (2.5YR3/2), reddish brown (2.5YR4/4), and yellowish red (5YR5/8) "fired aggregates"; common charcoal fragments; few fine roots; sand stripping evident on ped faces; numerous krotovina and worm casts; medium acid; gradual wavy boundary.
100-150	Dark reddish brown (5YR2.5/2) sandy loam with few pockets of strong brown (7.5YR5/8) loamy sand; weak fine granular structure; friable when disturbed; many charcoal fragments and few "fired aggregates"; few black concretions in lower part of horizon; few fine roots; strongly acid; clear smooth boundary.
150-180	Dark reddish brown (5YR3/2) and strong brown (7.5YR5/6) sandy loam; weak fine granular structure; friable when disturbed; few charcoal fragments; sand stripping on vertical ped faces; few "fired aggregates"; strongly acid; gradual wavy boundary.
180-195	Dark yellowish brown (10YR4/4) sandy loam with common medium strong brown (7.5YR4/6) and yellowish red (5YR5/8) mottles; weak coarse prismatic parting to weak fine subangular blocky structure; firm; vertical seams filled with very pale brown (10YR7/4) fine sand and silt form polygonal structure, sand stripping has occurred in seams; common fine rounded black concretions; purple stains extend vertically along ped faces in upper part of horizon; strongly acid; gradual smooth boundary.
195-250	Brownish yellow (10YR6/6) sandy loam with common medium dark yellowish brown (10YR4/4), strong brown (7.5YR4/6) and yellowish red (5YR5/8) mottles; massive parting to weak coarse prismatic structure; slightly firm in place; polygonal seams filled with very pale brown fine sand and silt stripped of clay; common black round concretions; medium acid; gradual diffuse boundary.
250-275	Mottled yellowish brown (10YR5/8), dark yellowish brown (10YR4/4), strong brown (7.5YR5/8), and pale brown (10YR6/3) sandy loam; massive; slightly firm in place, friable when disturbed; few black ferromanganese concretions; strongly acid.

Close examination of the soil profile revealed subtle differences within the dark-colored epipedon. Differences in texture and consistency were most apparent with gradual changes in the class or grade of granular structure. Because the site had elevations above the adjacent floodplain it had been subjected to intense pedoturbation by insects, crawfish, and burrowing rodents which formed krotovinas and retarded pedogenic development.

The dark-colored epipedon graded into a well-developed paleosol at depths of 130-150 cm (51.2-59.1 in). The paleosol exhibited a pronounced color change with hues of 10YR and increased clay content accompanied by well-expressed prismatic structure which parted to subangular blocky structure. Ped faces in the paleosol had oriented clay skins and sand bridging by clay and iron oxides. Micro-morphological analyses of the paleosol revealed paleo-argillans throughout the matrix. The morphological and physical features are diagnostic of argillic horizons. There was no evidence of the ancestral surface (A) horizon of the buried paleosol. Coarser textured, humic-coated sediments of different morphological characteristics rested upon the paleosol suggesting truncation of the original surface by fluvial erosion.

The paleosol had a distinctive polygonal morphology comprised of prisms (0.5-1.5 m or 1.7-5 in diameter) separated by leached, silty and very fine sand seams. The seam materials were stripped of clay. The seams ranged from 1-3 cm (.4-1.2 in) wide at the top of the paleoargillic horizon, and they became thinner with increasing depth. Seams commonly extended to depths of 1 m (3.3 ft) and bisected preexisting structural features and peds with horizontal cutans.

The thickness of the paleoargillic horizon and the well-developed structure and oriented clay skins on ped faces indicate the paleosol developed over a long period of landscape stability prior to the burial. The soil development and pedogenic expression in the paleosol was comparable to that of well-developed, upland mature soils of adjacent Pleistocene upland surfaces.

Particle size data (Table 52 and 53) indicate discrete fluvial depositions. The highest silt content occurred in the surface layer (0-15 cm/0-5.9 in) and decreased with depth. Sand contents generally increased with depth. Highest clay contents were associated with the paleoargillic horizon of the paleosol. The sand fraction was dominated by the fine (0.25-0.10 mm) and very fine (0.10-0.05 mm) classes. Although textural variations occurred within the site as reflected by data in Tables 51 and 52 from different locations on the site, a higher degree of textural uniformity existed than was detected in the adjacent floodplain as shown in Table 53. Higher clay contents and greater variations in silt and clay contents occurred off-site. Textural bedding planes were also evident in the adjacent off-site soils that were not readily evident in the soils comprising the site which suggests greater stability. However, different depositional energy gradients are shown by the constant sand fabric (Figure 32).

TABLE 51
Particle size distribution of selected soil samples, 22It539.

Depth	Sand (2 - 0.05 mm)	Silt (0.05 - 0.002 mm)	Clay (< 0.002 mm)	Texture
(cm)	percentage			
0-15	53.00	42.08	4.92	sandy loam
15-37	53.64	36.88	9.48	sandy loam
37-60	50.10	39.69	10.21	loam
60-100	56.17	31.10	12.73	sandy loam
100-150	55.92	30.29	13.79	sandy loam
150-180	55.65	25.84	14.51	sandy loam
180-195	71.34	21.11	7.55	sandy loam
195-250	69.88	20.45	9.67	sandy loam
250-275	64.76	23.67	11.57	sandy loam

TABLE 51
Particle size distribution of selected soil samples, 22It539 (continued).

	Sand Fraction				
Depth	Very Coarse (2-1 mm)	Coarse (1-.5 mm)	Medium (.5-.25 mm)	Fine (.25-.10 mm)	Very Fine (.10-.05 mm)
(cm)	percentage				
0-15	0.09	0.52	3.18	33.81	15.40
15-37	0.07	0.17	2.32	33.54	17.54
37-60	0.05	0.24	1.86	34.55	13.39
60-100	0.09	0.21	3.52	37.75	14.60
100-150	0.02	0.10	4.36	37.52	13.91
150-180	0.02	0.06	2.95	39.09	17.51
180-195	0.01	0.01	3.72	49.72	17.87
195-250	0.00	0.01	2.37	46.93	20.57
250-275	0.00	0.01	2.67	43.72	18.36

TABLE 52
Particle size distribution of typical pedon from Block A, 22It539.

Level	Depth (cm)	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Texture
1	0-10	66.94	27.40	5.66	sandy loam
2	10-20	62.14	31.00	6.86	sandy loam
3	20-30	62.36	30.79	6.85	sandy loam
4	30-40	62.33	29.04	8.63	sandy loam
5	40-50	63.86	29.04	7.10	sandy loam
6	50-60	65.43	27.72	6.85	sandy loam
7	60-70	64.58	28.33	7.09	sandy loam
8	70-80	63.77	26.84	9.39	sandy loam
9	89-90	63.51	26.31	10.18	sandy loam
10	90-100	64.11	26.47	9.42	sandy loam
11	100-110	64.27	28.61	7.12	sandy loam
12	110-120	64.33	28.56	7.11	sandy loam
13	120-130	62.94	28.94	8.13	sandy loam
14	130-140	58.95	29.08	11.97	sandy loam
15	140-150	56.03	31.15	12.82	sandy loam
16	150-160	53.60	29.77	16.63	sandy loam
17	160-170	56.92	28.07	15.01	sandy loam
18	170-180	66.76	23.91	9.33	sandy loam
19	180-190	67.52	23.15	9.33	sandy loam
21	200-210	70.81	17.81	11.38	sandy loam
22	210-220	69.98	16.82	13.32	sandy loam

	Sand Fraction				
Level	Very Coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.10 mm)	Very Fine (0.10-0.05 mm)
	percentage				
1	0.09	2.48	4.83	42.48	18.06

TABLE 52
Particle size distribution of typical pedon from Block A, 22It539 (continued).

Sand Fraction

Level	Very Coarse (2-1mm)	Coarse (1-0.5mm)	Medium (0.5-0.25mm)	Fine (0.25-0.10mm)	Very Fine (0.10-0.05mm)
	percentage				
2	0.06	0.13	3.70	41.04	17.21
3	0.07	0.10	3.65	41.33	17.21
4	0.03	0.06	3.27	41.12	17.85
5	0.03	0.07	3.37	43.02	17.37
6	0.03	0.18	4.22	44.70	16.30
7	0.02	0.09	3.78	43.06	17.63
8	0.02	0.11	3.94	43.46	16.24
9	0.01	0.08	3.64	43.32	17.46
10	0.00	0.06	3.68	41.48	18.89
11	0.04	0.11	3.64	42.65	17.83
12	0.00	0.08	3.93	42.77	17.55
13	0.01	0.04	3.60	42.07	17.18
14	0.05	0.12	3.05	38.35	17.38
15	0.04	0.08	3.32	36.07	16.52
16	0.01	0.04	2.57	34.72	16.26
17	0.02	0.04	2.66	37.55	16.65
18	0.01	0.03	2.81	44.27	19.64
19	0.01	0.01	2.57	44.35	20.58
21	0.00	0.01	3.14	48.80	18.86
22	0.00	0.02	3.37	49.49	17.10

TABLE 53
Particle size analyses and pH of soils adjacent to 22It539.

Sample	Depth	Sand	Silt	Clay	Texture	pH
Terrace east of site	15-30	68.0	14.7	17.2	SL	4.9
Bordering floodplain	45-63	62.8	12.6	24.6	SCL	4.8
Middle of floodplain east of site	0-30	25.8	43.2	31.0	CL	4.8
Middle of floodplain east of site	50-75	30.7	39.7	29.6	CL	4.4
Middle of floodplain east of site	75-105	36.4	33.3	30.3	CL	4.8
Floodplain 75 m east of site	30-60	28.2	42.9	28.9	CL	4.8
Floodplain 75 m east of site	75-100	35.2	40.0	24.8	L	4.7
Floodplain 20 m east of site	25-50	43.0	32.5	24.5	L	4.7
Floodplain 20 m east of site	85-125	47.1	23.2	29.7	SCL	4.7
Floodplain 75 m west of site	5-30	40.7	36.2	23.1	L	5.0

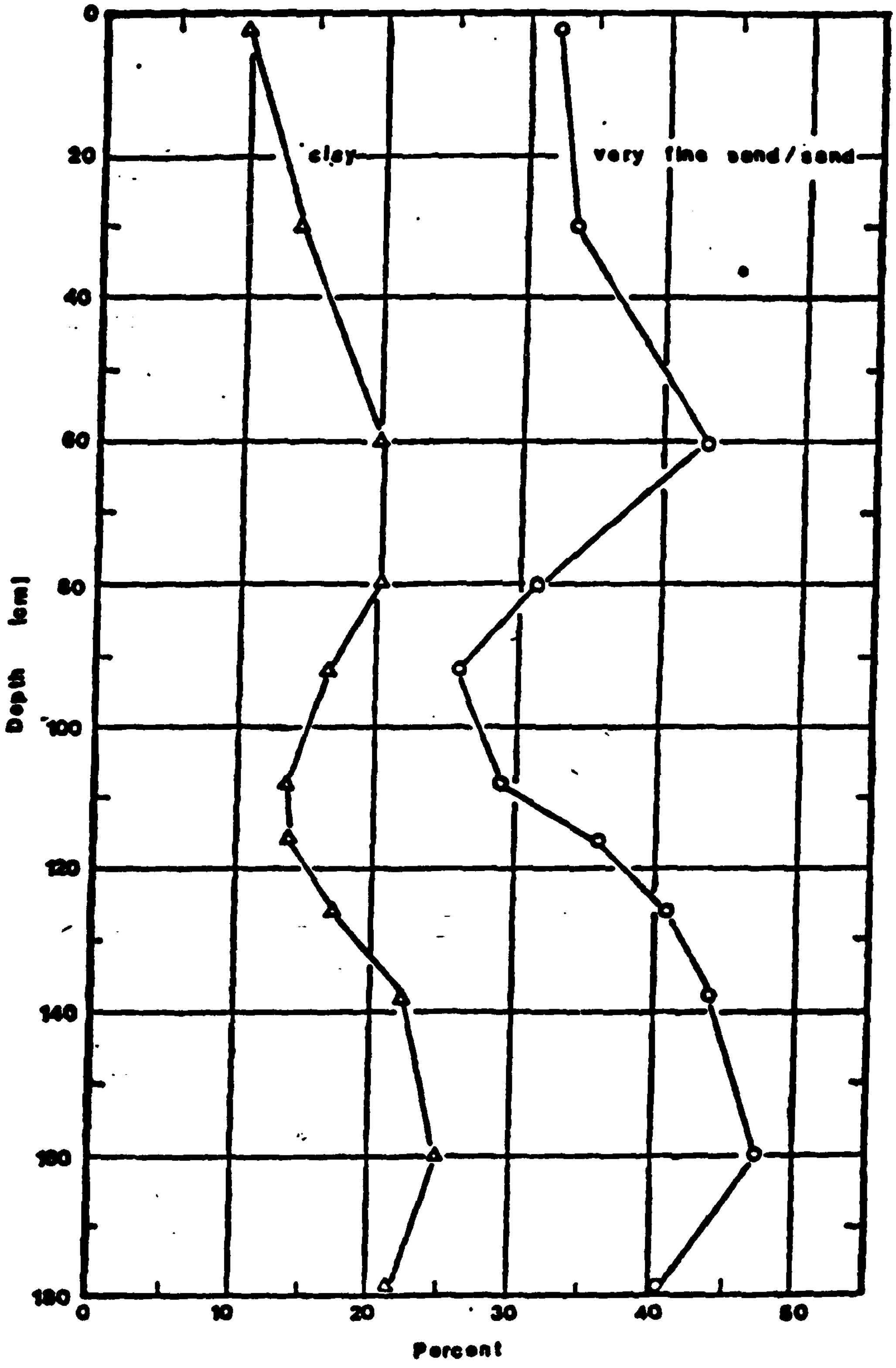


Figure 32 Constant sand fabric, 22It539.

TABLE 53

Particle size analyses and pH of soils adjacent to 22It539 (continued).

Sample	Depth	Sand	Silt	Clay	Texture	pH
Floodplain 75 m west of site	62-88	39.7	36.3	24.0	L	4.8
Floodplain 120 m west of site	15-37	50.4	29.0	20.6	L	4.8
Floodplain 120 m west of site	40-50	78.9	13.0	8.1	LS	4.8
Floodplain 40 m south of site	25-50	65.5	20.3	14.2	SL	5.0
Floodplain 40 m south of site	55-85	63.6	23.4	13.0	SL	5.3
Floodplain 40 m south of site	90-125	80.7	12.5	6.8	LS	4.5
Floodplain 40 m south of site	5-37	16.6	46.9	36.5	SiCL	4.9
Floodplain 40 m south of site	100-125	14.5	50.2	35.3	SiCL	4.4
Floodplain 75 m north of site	15-37	34.9	40.5	24.6	L	4.9
Floodplain 75 m north of site	87-11	42.3	35.7	22.0	L	4.7

* Texture: L = loam; SL = sandy loam; SCL = sandy clay loam; LS = loamy sand; CL = clay loam; SiCL = silty clay loam

The presence of illuviation, greater soil structure development, sand bridging and oriented clay skins on ped faces in the subsoil indicates greater pedogenic development in the deeper strata in comparison to the upper 1.25 m (4.1 ft). The soil morphological expressions appear to be relic features of previous soilscapes that were subsequently buried by fluvial sediments. The pedogenic development in the subsoil of the site contrasted sharply with the undifferentiated, gleyed, stratified soils of the adjacent floodplain (Table 49).

CHEMICAL DESCRIPTION

Calcium and hydrogen (acidity) were the dominant exchangeable cations of the pedons analyzed (Table 54). Calcium contents varied in different levels and generally decreased with increasing depths. Calcium/magnesium ratios exceeded 7:1 throughout the pedon. Potassium levels were highest in the surface layer and in the upper horizons of the paleosol. Trace levels of sodium were present. Exchangeable aluminum levels increased with depth reaching maximum values in the paleoargillic horizons. Exchangeable aluminum levels are generally associated with intense weathering and age. Cation exchange capacities were greater in the upper layers and decreased in the buried paleosol reflecting differences in organic matter content and mineralogy. Exchangeable cation levels and cation exchange capacity values of the paleosol were similar to upland Pleistocene soils of the adjacent valley wall.

TABLE 54
Chemical characteristics of representative pedon, 22It539.

Depth	pH	Ca	Mg	K	Na	H+	Al*	Total**	Base Saturation
		Exchangeable Cations							
cm		----------Cmol (p+) kg-1----------							
0-15	5.9	6.73	0.90	0.18	0.02	9.85	0.04	17.68	44.29
15-37	5.8	3.81	0.46	0.09	0.02	6.79	0.06	11.17	39.21
37-60	5.5	5.03	0.38	0.08	0.02	8.12	0.34	13.63	40.43
60-100	5.6	6.76	0.65	0.08	0.02	10.02	0.22	17.53	42.83
100-150	5.5	6.24	0.65	0.13	0.03	10.16	0.84	17.21	40.96
150-180	5.5	5.32	0.44	0.11	0.02	7.98	0.81	13.87	42.47
180-195	5.5	2.73	0.22	0.06	0.02	3.15	0.57	6.18	49.03
195-250	5.6	3.07	0.27	0.06	0.02	3.01	0.62	6.43	53.19
250-275	5.2	3.59	0.27	0.08	0.02	4.91	1.46	8.87	44.64

* not included in total
** cation exchange capacity by summation
\+ acidity

Organic matter content was greatest in the surface horizon and had abrupt changes with depth (Table 55). Organic matter and C levels varied across the site as shown by differences in Tables 55 and 56 for different pedons. Total N levels showed similar distribution differences. Large variations occurred in the C/N ratios for different layers (Table 56) The C/N ratio of soil surface horizons normally ranges from 10-12/1 and decrease with depth (Fitzpatrick 1980) with some middle horizons having ratios as low as four. The lower C/N values of some subsoils has been attributed to high contents of ammonium ions fixed by clay as a possible mechanism (Fitzpatrick 1980). In contrast to natural undisturbed soils, the pedons analyzed (Table 53) had dramatic increases in the C/N ratio in the layers from 50-150 cm (19.7-59.1 in) with ratios exceeding 20/1. Ratios abruptly decreased at depths below 160 cm (63 in), with lowest values occurring in the deepest layers analyzed.

TABLE 55
Organic matter, free iron oxides, total P and 1% citric acid extractable P205 levels of selected pedon, 22It539.

Depth	Organic Matter	Fe203	Total P	1% Citric Acid Extractable P205
(cm)	--------percentage-------		------------ppm------------	
0-15	2 75	1.3	509	183.9
15-37	0.73	1.8	422	223.8
37-60	0.96	1.3	574	305.8
60-100	1.38	1.2	563	368.5
100-150	1.03	1.4	702	532.2
150-180	0.46	1.2	667	591.8
180-195	0.09	0.7	327	181.8
195-200	0.06	0.8	336	142.5
250-275	0.08	1.3	535	182.9

TABLE 56

Organic matter, pH, carbon, nitrogen contents, carbon/nitrogen ratio, and 1% citric acid soluble P205 contents of representative pedon, Block A, 22It539.

Level	Depth	Organic Matter	pH	C	N	C/N	1% Citric Acid Soluble P205
	(cm)	percentage					ppm
1	0-10	4.20	5.1	2.43	0.390	6.2/1	414.78
2	10-20	1.15	6.3	0.66	0.066	10.0/1	395.83
3	20-30	0.61	6.3	0.35	0.039	8.9/1	469.39
4	30-40	0.67	6.1	0.39	0.031	12.5/1	468.91
5	40-50	0.77	5.9	0.45	0.028	16.0/1	425.96
6	50-60	1.25	5.9	0.72	0.025	29.0/1	344.13
7	60-70	0.92	5.9	0.53	0.023	23.0/1	343.78
8	70-80	1.04	6.1	0.60	0.026	23.0/1	526.85
9	80-90	1.14	6.1	0.66	0.026	25.0/1	528.99
10	90-100	1.25	6.1	0.72	0.024	30.0/1	507.10
11	100-110	1.55	6.0	0.90	0.025	36.0/1	548.78
12	110-120	1.58	5.9	0.92	0.023	40.0/1	549.34
13	120-130	1.58	5.8	0.92	0.024	38.0/1	752.03
14	130-140	1.40	5.8	0.81	0.029	28.0/1	1228.25
15	140-150	1.40	5.6	0.81	0.035	23.0/1	1132.85
16	150-160	1.28	5.8	0.74	0.035	21.0/1	1977.34
17	160-170	0.79	5.8	0.46	0.033	14.0/1	1753.31
18	170-180	0.20	6.0	0.11	0.017	6.5/1	626.90
19	180-190	0.15	5.9	0.08	0.017	4.7/1	506.59
21	200-210	0.13	6.0	0.07	0.016	4.3/1	284.26
22	210-220	0.11	5.9	0.06	0.016	3.7/1	284.55

Soil pH levels varied slightly with depth and location across the site (Tables 52 and 56). The low pH value of the surface (0-10 cm/0-3.9 in) layer of the pedon of Block A is associated with the higher organic matter content. The soil pH levels in the site were considerably higher than adjacent floodplain soils, which had average levels below five. The higher pH values in the site are associated with higher calcium levels.

In addition to specific requirements for organic matter content, color and other properties; anthropic epipedons are required to have at least 250 ppm P_2O_5 extractable in 1% citric acid (Soil Taxonomy 1965). All the layers analyzed in the Block A pedon had levels exceeding 250 ppm (Table 56), with maximum values occurring at depths of 130-170 cm (51.2-67 in). The citric acid (1%) extractable P_2O_5 levels could be associated with population, time of occupation, or types of activities. Some variation occurs in the citric acid soluble P_2O_5 across the site and with depth as shown in Tables 56 and 57, as might be expected. Citric acid extractable P_2O_5 levels of adjacent off-site soils were less than 150 ppm for selected samples analyzed.

MINERALOGICAL DESCRIPTION

Kaolinite was the dominant mineral in the clay fraction with lesser amounts of illite, vermiculite-chlorite intergrade, smectite, and quartz. Vertical layers did not exhibit discrete clay mineral suites, but reflected the depositional fluvial environment. However, vermiculite-chlorite intergrade content decreased with depth, and it was not detected in the underlying paleosol horizons. The absence of chlorite-vermiculite in the paleosol relative to the superjacent horizons suggests greater weathering in the paleosols. This finding agrees with data of Ruhe et al. (1974) who studied paleosols in Indiana. Sand and silt fractions were dominated by quartz with lesser amounts of mica, glauconite, and feldspar.

MICRO-MORPHOLOGICAL DESCRIPTION

Examination of natural soil peds and separated sand fractions were done for selected samples via conventional light microscopy. Representative samples of the dark-colored, humic-stained upper layers and subjacent paleosol layers were examined in detail.

EPIPEDON

The skeletal matrix (sand and silt) was comprised dominantly of sand grains which were uniformly coated with reddish brown and black organic matter. The individual coated sand grains were bound or cemented by humus into clusters or domains which formed moderate to strong granular structures. The structural units are resistant to disruption by water and they tend to wet very slowly, suggesting a high capillary contact angle. Shaking the soil in 0.05 N NaOH removes or "strips" the humus coating revealing angular and rounded, clear quartz grains. The sand grains become loose and single grained after removal of the coating and tend to re-wet readily. The epipedon of the midden mound presents a striking contrast in comparison to adjacent floodplain soils. The adjacent soils have a very thin (0-6 cm/0-2.4 in) surface layer that is not as dark colored with Munsell hues of 10YR and which has a "salt and pepper" appearance with mostly uncoated quartz grains and unbound organic matter. The non-site soils have much less defined structural units and tend to wet more readily.

Additional tests were conducted to characterize further the nature of the humus coating. Immersion of the humic-stained soil in water for 12 hours with shaking resulted in no unbound or "free" organic matter, and the structural domains persisted. Treatment of the epipedon with 0.5 NaOH and gentle shaking removed the humus coating and resulted in a reddish brown extract. Addition of 0.5 HCl to the colored extract resulted in complete flocculation of the organic material leaving a clear supernatant indicating dominantly humic acid compounds (McKeague 1968). The color ratio of 0.5 N NaOH extract solutions was determined to characterize further the coating materials. The color ratio of:

$$E4/E6 = \frac{\text{extinction (absorbance) at 400 nm}}{\text{extinction (absorbance) at 600 nm}}$$

has been used for differentiation of humic substances (Tan 1982). Fulvic acids yield spectra with a steep slope in contrast to humic acids. According to research by Tan (1982), a low color ratio less than seven corresponds to humic acids and related compounds with high molecular weights.

Color ratio values for the representative pedon of Block A (Table 57) indicate dominantly humic acid compounds. Values slightly exceed seven at depths of 210 cm (82.7 in) and greater.

TABLE 57
Color ratio values of NaOH extracts of pedon from Block A, 22It539.

Level	Depth (cm)	Color Ratio Value = absorbance 400 nm / absorbance 600 nm
1	0-10	6.13
2	10-20	5 72

TABLE 57
Color ratio values of NaOH extracts of pedon from Block A, 22It539 (continued).

Level	Depth (cm)	Color Ratio Value = $\frac{\text{absorbance 400 nm}}{\text{absorbance 600 nm}}$
3	20-30	5.52
4	30-40	5.37
5	40-50	4.55
6	50-60	3.84
7	60-70	3.82
8	70-80	4.42
9	80-90	4 34
10	90-100	3.96
11	100-110	3.78
12	110-120	3.52
13	120-130	3.72
14	130-140	4.21
15	140-150	4.08
16	150-160	4.54
17	160-170	5.26
18	170-180	6.15
19	180-190	6.50
21	200-210	7.33
22	210-220	7.50

PALEOSOL

Microscopic examinations revealed that paleosols commonly have a fine-grained S-matrix with void argillans and embedded grain argillans dispersed throughout the matrix. Voids were typically smaller in the paleoargillic horizons than exist in the overlying epipedons. The paleosol had a high content of vesicular pores. The paleosol tended to have compound structure with prismatic parting to well-developed subangular blocky structure. The polygonal seams between prisms were highly leached and stripped of fines.

SUMMARY

Site 22It539 was located in the eastern part of the Tombigbee River floodplain about 700 m (2,310 ft) west of the eastern Pleistocene valley wall. Lower-lying parts of the site were subject to flooding during winter and spring months. The site soil was distinguished by very thick, humus-rich, dark reddish brown sandy loam upper layers ranging one meter (3.3 ft) and greater in thickness. The dark-colored epipedon had Munsell hues of 5YR which contrasted sharply to adjacent off-site soils. Organic matter contents ranged from 2.75% in the surface layer to 0.08% at depths below 250 cm (98.5 in). The dark-colored epipedon graded into a well-developed paleosol at depths of 130-150 cm (51.2-59.1 in). The paleosol had color hues of 10YR and increased clay content accompanied by well-developed structural units. The paleosol had a distinctive polygonal morphology comprised of prisms separated by highly leached silty and sandy seams. Soil development and pedogenic expression in the paleosol was comparable to well-developed mature soils of adjacent Pleistocene upland surfaces. Sand contents increased with depth, and the sand fraction was dominated by fine and very fine sand. The presence of illuviation, greater soil structural development, sand-bridging, and oriented clay skins on ped faces in the paleosol indicate greater pedogenic development in comparison to the upper 1.25 m (4.1 ft).

Calcium and hydrogen (acidity) were the dominant exchangeable cations of the site soil. Calcium contents varied in different levels and generally decreased with increasing depths. Calcium levels were several fold greater than levels of adjacent non-site soils. Potassium levels were highest in the surface layer and the upper horizons of the paleosol. Trace levels of sodium were detected with no accumulations. Exchangeable aluminum levels increased with depth with maximum values occurring in the paleoargillic horizons. Soil pH varied with depth and location across the site, but values were considerably higher than off-site soils. Base saturation levels were also higher in the site soil than adjacent off-site reflecting cultural addition of cations to the site.

Total nitrogen contents decreased with depth and did not correspond to increased organic carbon levels at different depths. The site had erratic C/N ratios which differed markedly from non-site soils. All the layers of the site soil contained greater than 250 ppm citric acid (1%) soluble P_2O_5, which is one criteria for anthropic epipedons. Maximum P205 values occurred at depths of 100-180 cm (39.4-70.9 in) reflecting cultural additions.

Kaolinite was the dominant mineral in the clay fraction with lesser amounts of illite, vermiculite-chlorite integrade, smectite, and quartz. Sand and silt fractions were dominated by quartz with lesser amounts of mica, glauconite, and feldspar. Vertical layers did not exhibit discrete clay mineral suites.

The skeletal matrix (sand and silt) of the dark-colored epipedon was comprised of sand grains which were uniformly coated with reddish brown and black humus. The coated sand grains were cemented by humus into clusters forming granular structure. The humus coating was not removed by repeated wetting and drying. Analyses indicated the amorphous coating was dominantly comprised of humic acid compounds.

THE POPLAR SITE (22It576)

The site occupied a topographic high in the eastern part of the Tombigbee River floodplain about 300 m (990 ft) west of the valley wall. The floodplain had slopes of 0-2% in contrast to slopes of 2-5% for the occupation mound (Figure 33). Local microrelief existed in the floodplain due to scouring and filling by flood waters. The level floodplain merged abruptly with the steep valley walls.

The site appeared to be a topographic feature caused by natural fluvial deposition. It was surrounded by a narrow slough (Figure 33) which appeared to be aggrading. The slough was much wetter throughout the year than adjacent areas in the floodplain.

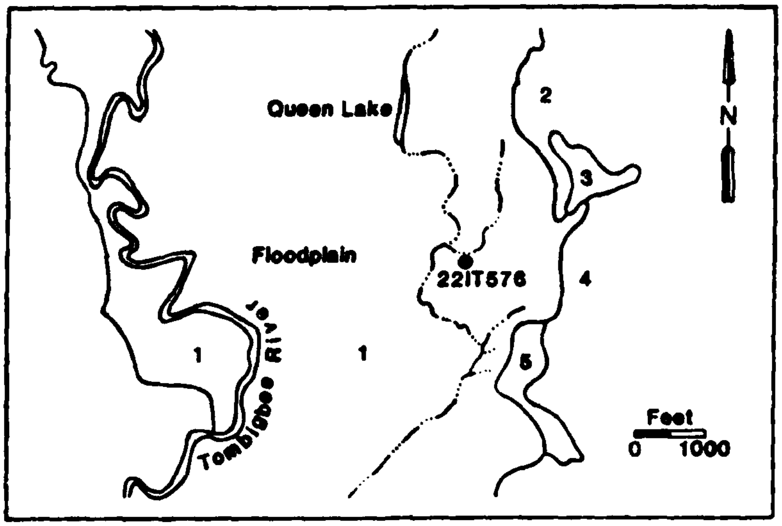
The bottom sediments of the slough were dominantly blue-gray and olive-colored silt loam and silty clay loam overlying loamy materials. The blue-gray color reflected the gleyed conditions resulting from wetness and lack of aeration. The floodplain sediments were siliceous but contained considerable glauconite and mica.

Mature, well-developed soils with distinct eluviated E horizons and illuviated argillic horizons (Bt) comprised the upland areas adjoining the floodplain. Smithdale soils (Figure 31) of the upland areas directly east of the site had red subsoils that contained up to 35% clay in the argillic horizons. The upland soils were very strongly acid, highly weathered, and siliceous with low base saturation levels (Ultisols). The Ora soils located in the uplands northeast of the site had dense, firm fragipan horizons at depths of 50-75 cm (19.7-29.5 in).

The floodplain surrounding the site was comprised of Kirkville and Mantachie soils which had minimal pedogenic development (Table 58). These soils had brown and yellowish brown surface horizons and gray, light gray, or pale brown (Table 59) subsoils with loamy textures. The floodplain soils had cambic Bw horizons (color B) with little eluviation and illuviation. They were strongly acid.

TABLE 58
Classification of soils comprising Site 22It576 and vicinity.

Soil Series	Classification
Harleston	coarse-loamy, siliceous, thermic Aquic Paleudults
Kirkville	coarse-loamy, siliceous, thermic Fluvaquentic Dystrochrepts
Luverne	clayey, mixed, thermic Typic Hapludults
Mantachie	fine-loamy, siliceous, acid, thermic Aeric Fluvaquents
Ora	fine-loamy, siliceous, thermic Typic Fragiudults
Smithdale	fine-loamy, siliceous, thermic Typic Paleudults



SOIL LEGEND

SYMBOL	NAME
1	Kirkville-Mantachie Association
2	Luverne fine sandy loam, 12 to 25 percent slopes
3	Ora fine sandy loam, 5 to 8 percent slopes, eroded
4	Smithdale Association, hilly
5	Harleston fine sandy loam

Figure 33 Soils in the vicinity of 22It576.

TABLE 59
Munsell color of selected horizons of representative soils in the floodplain adjacent to Site 22It576.

Sample	Depth (cm)	Munsell Color (moist)
Hole 1 North	75-90	Gray (10YR5/1)
Hole 1 North	100	Gray (10YR5/1)
Hole 2 South	30-50	Light gray (10YR7/2)
Hole 2 South	50-70	Light gray (10YR7/2)
Hole 2 South	70-92	Light brownish gray (10YR6/2)
Hole 2 South	92-112	Gray (10YR5/1)
Hole 3 South	50-75	Light gray (10YR7/2)
Hole 4 East	25-50	Gray (10YR5/1)
Hole 5 East	10-30	Dark brown (10YR4/3)
Hole 5 East	50-70	Light brownish gray (10YR6/2)
Hole 6 West	80-100	Gray (10YR8/1) with (10YR5/6) mottles
Hole 7 Southwest	65-75	Gray (10YR8/1)
Hole 8 Southwest	0-30	Pale brown (10YR8/3) and gray (10YR5/1)
Hole 8 Southwest	30-40	Light gray (10YR7/2)

The culturally altered soils of the site developed in loamy, fluvial, siliceous sediments. These soils were readily distinguished by very thick, humus rich, dark reddish brown epipedons (surfaces) which were due to prolonged cultural activity and habitation. Past occupation of the site had drastically altered normal pedogenic features of color, structure, consistency, horizonation, organic matter content, and certain chemical parameters. The soil comprising the occupation locale was distinct, and it differed greatly from adjacent soils of the region.

Profuse populations of earthworms, crawfish, rodents, and other diverse microfauna and microflora thrived in the organic-rich site which was elevated above the adjacent floodplain and seasonal wetness. Faunal and floral pedoturbation in addition to the human activities had tended to mix the upper meter of soil and affected normal pedogenic development. The dark-colored humic staining of the upper meter (3.3 ft) also tended to mask the natural horizonation.

PHYSICAL DESCRIPTION

The upper meter (3.3 ft) of the mound soil was dark reddish brown with a moist hue of 5YR (Table 57 and Figure 34) which differed markedly from the adjacent floodplain soils which had hues of 10YR (Table 60).

TABLE 60
Pedon description of representative profile, 22It576.

Depth (cm)	Description (moist colors)
0-10	Dark reddish brown (5YR3/2) loam; moderate-fine and medium granular structure; very friable; many fine and medium roots; few small black (10YR2/0) charcoal fragments; greasy when rubbed; strongly acid; clear smooth boundary.

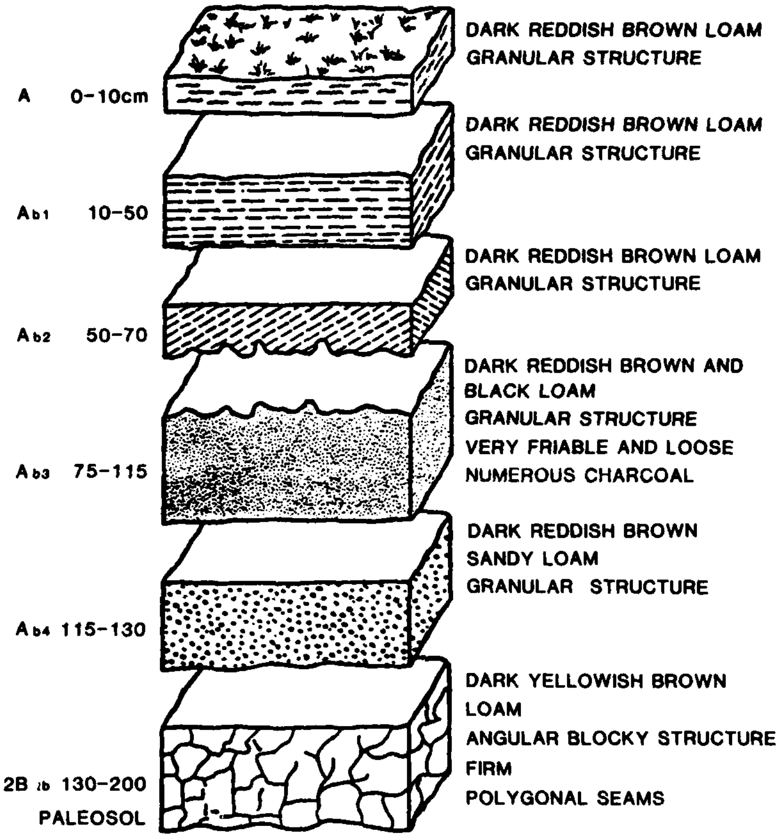


Figure 34 Soil profile, 22It576.

TABLE 60

Pedon description of representative profile, 22It576 (continued).

Depth (cm)	Description (moist colors)
10-51	Dark reddish brown (5YR2.5/2) loam; moderate-fine granular structure; slightly firm in place, friable when disturbed; many fine and medium roots; few small charcoal fragments; common small and medium very dark gray (10YR3/1) and dark gray (10YR4/1) potsherd in upper part of horizon; medium acid; greasy when rubbed; gradual wavy boundary.
51-75	Dark reddish brown (5YR3/3) loam; weak-fine granular structure; slightly firm in place, friable when disturbed; common small roots; few mottled dusky red (2.5YR3/2), reddish brown (2.5YR4/4), yellowish red (5YR5/8) "fired aggregates"; common small black charcoal fragments; medium acid; greasy when rubbed; gradual wavy boundary.
75-87	Dark reddish brown (5YR3/2) and strong brown (7.5YR5/6) loam with streaks of light brownish gray (10YR6/2) and black (10YR2/0); weak-fine granular structure; very friable; abundant black and very dark gray multi-sized charcoal fragments; few fine roots; medium acid; gradual wavy boundary.
87-97	Dark reddish brown (5YR3/2) and strong brown (7.5YR5/6) sandy loam with common medium light brownish gray (10YR6/2) mottles; weak-fine granular structure; friable; common black charcoal fragments; medium acid; gradual wavy boundary.
97-113	Reddish brown (5YR4/4) and strong brown (7.5YR5/6) sandy loam; weak-fine granular structure; slightly firm; few fine charcoal fragments; few fine round black concretions; slightly acid; gradual wavy boundary.
113-120	Strong brown (7.5YR5/6) and dark brown (7.5YR4/4) loam; weak-fine granular structure; slightly firm; few fine black concretions; purple stains extend vertically; slightly acid; gradual wavy boundary.
120-130	Strong brown (7.5YR4/6) loam with common medium brown (10YR5/3) mottles; weak fine granular structure; slightly firm; common fine and medium round black concretions; purple stains extend vertically along ped faces; medium acid; smooth wavy boundary.
130-146	Dark yellowish brown (10YR4/4) with common medium strong brown (7.5YR4/6), dark brown (7.5YR3/4) and yellowish red (5YR5/8) mottles; weak fine platy structure that parts to weak-fine subangular blocky structure; firm; thin seams filled with very pale brown (10YR4/4) silt and very fine sand form an intermittent polygonal network; firm; patchy clay skins and intergranular bridging; common black ferromanganese concretions; strongly acid; gradual irregular boundary.

TABLE 60
Pedon description of representative profile, 22It576 (continued).

Depth (cm)	Description (moist colors)
146-184	Mottled pale brown (10YR6/3), brownish yellow (10YR6/8), strong brown (7.5YR5/8), yellowish red (5YR5/8), and red (2.5YR4/8) loam; massive parting to weak fine subangular structure; firm; seams ranging to 0.5 cm (.2 in) width and filled with very pale brown (10YR4/4) silt and very fine sand form a continuous polygonal structure, sand stripping has occurred in the seams; common ferromanganese concretions; clay skins on ped faces and within larger pores; strongly acid; gradual irregular boundary.
184-200+	Mottled yellowish brown (10YR5/6), pale brown (10YR6/3), olive yellow (2.5Y6/8), brownish yellow (10YR6/8), and reddish yellow (7.5YR6/6) loam; massive; slightly firm; few black ferromanganese concretions; strongly acid.

The mound soil epipedon had a Munsell value which changed at least one unit from wet to dry in contrast to adjacent soils which did not exhibit this color change. The dark reddish brown epipedon had a distinct "greasy" or slick feel when rubbed between the fingers. The dark epipedon graded into a paleosol at depths ranging from 130-150 cm (51.2-59.1 in). The paleosol exhibited a pronounced change in color with hues of 10YR and increases in clay content accompanied by a structural change to subangular blocky. Ped faces in the paleosol had oriented clay skins and sand bridging by clay which is characteristic of argillic horizons. A very pronounced polygonal network permeated the paleosol, with the polygons separated by seams filled with silt and very fine sand which had been stripped of clay. Clay content decreased in the lower horizon of the paleosol and structure changed to massive. The horizons from 130-184 cm (51.2-72.5 in) had well-developed ped faces characteristic of argillic horizons which occur on upland mature soils of the region. Typically, below the dark-colored epipedon and above the brighter colored paleosol, the humic materials formed horizontal bands or lamellae where vertical water flow had been retarded by the less permeable underlying paleosol.

The thickness of the paleoargillic horizon and the well-developed structure and oriented clay skins on ped faces suggest the paleosol formed over a period of landscape stability prior to burial. The pedogenic development in the paleosol was comparable to well-developed, upland soils of adjacent Pleistocene geomorphic surfaces. Micro-morphological analyses of the paleosol revealed the paleo-argillans extended throughout the matrix. There was no morphological evidence of the ancestral surface horizon of the buried paleosol. Other than the missing surface horizon, the paleosol appeared intact and well preserved under the burial sediments.

Particle size distributions (Table 61) suggest discrete fluvial depositions in the upper meter (3.3 ft) and reflect argillation in the underlying paleosol. Silt contents were generally higher in the surface layers, and clay increased with depth reaching maximum levels in the paleoargillic horizon. Fine (0.25-0.10 mm) and very fine (0.10-0.05 mm) sand fractions were dominant with only trace amounts of coarse (0.25-0.10 mm) and very coarse (2-1 mm) sand. Although textural variations existed in the site, a higher degree of textural uniformity existed than was detected in the adjacent floodplain soils (Table 62). Prominent textural bedding representing fluvial depositions was very evident in the adjacent off-site soils in the active floodplain, which indicates the site had greater stability for pedogenesis.

TABLE 61
Particle size distribution of representative pedon, 22It576.

Depth	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Texture
(cm)	percentage			
0 - 10	47.2	42.8	10.0	Loam
10 - 51	48.4	37.2	14.4	Loam
51 - 75	46.6	33.3	20.1	Loam
75 - 87	48.8	30.9	20.3	Loam
87 - 97	57.7	25.5	16.8	Sandy Loam
97 - 113	56.5	29.5	14.0	Sandy Loam
113 - 120	50.4	35.3	14.3	Loam
120 - 130	42.7	39.6	17.7	Loam
130 - 146	39.0	38.1	22.9	Loam
146 - 184	38.3	36.5	5.2	Loam
184 - 200	48.0	30.2	21.8	Loam

Sand Fraction

Depth	Very Coarse (2-1 mm)	Coarse (1-.5 mm)	Medium (.5-.25 mm)	Fine (.25-.10 mm)	Very Fine (.10-.05 mm)
(cm)	percentage				
0 - 10	0.42	0.42	3.90	27.33	15.15
10 - 51	0.10	0.30	3.84	27.96	16.22
51 - 75	0.02	0.10	1.63	24.72	20.14
75 - 87	0.06	0.25	3.44	29.63	15.39
87 - 97	0.01	0.12	7.24	34.95	15.33
97 - 113	0.07	0.14	5.52	34.03	16.77
113 - 120	0.02	0.23	2.65	28.95	18.50
120 - 130	0.01	0.25	1.53	23.19	17.67
130 - 146	0.01	0.04	1.20	20.52	17.24
146 - 184	0.01	0.05	1.06	18.94	18.28
184 - 200	0.00	0.04	1.54	27.12	19.32

TABLE 62
Particle size distribution, pH, and organic matter contents of representative soils adjacent to Site 22It576.

Hole Sample	Depth	Sand	Silt	Clay	Texture	pH	Organic Matter
	cm	(2-.5mm)	(.05-.002mm)	(<.002mm)			
1 North	75-90	52.6	26.7	20.7	SCL	4.4	1.02
1 North	100	56.9	23.4	19.7	SL	5.0	0.43
2 South	30-50	45.2	29.9	24.9	L	4.9	0.57
2 South	50-70	76.6	13.5	9.9	SL	4.6	0.21
2 South	70-92	84.3	10.6	5.1	LS	5.1	0.15
2 South	92-112	79.6	9.8	10.6	LS	5.3	0.17

TABLE 62
Particle size distribution, pH, and organic matter contents of representative soils adjacent to Site 22It576 (continued).

Hole Sample	Depth	Sand	Silt	Clay	Texture	pH	Organic Matter
	cm	(2-.5mm)	(.05-.002mm)	(<.002mm)			
3 South	50-75	47.6	28.0	24.4	SCL	4.3	1.54
4 East	25-50	24.4	36.1	39.5	CL	4.3	2.69
5 West	10-30	42.7	27.4	29.9	SCL	4.8	1.42
5 West	50-70	41.4	27.7	30.9	CL	4.9	0.60
6 West	80-100	55.9	22.9	21.2	SCL	4.8	0.33
7 Southwest	65-75	40.6	30.5	28.9	CL	4.6	0.65
8 Southwest	0-30	36.8	38.5	24.7	L	4.9	1.58
8 Southwest	30-40	41.9	34.3	23.8	L	5.2	1.08

L=loam; SL=sandy loam; SCL=sandy clay loam; LS=loamy sand; CL=clay loam

The constant sand fabric illustrates the depositional gradients of the Poplar site (Figure 35). This method has been used to analyze the depositional environment characterizing a soil profile, assuming the sand fabric to be the skeletal matrix through which clay would move. Clay distribution suggests a downward translocation of particles from the upper horizons with a major discontinuity existing between the upper clay maxima about 60 cm (23.6 in) and the subjacent paleoargillic horizon.

Greater soil structural development, argillation accompanied by sand bridging, and oriented clay skins on ped faces in the paleosol indicate greater pedogenic development in the deeper strata relative to the upper 130 cm (51.2 in). The profile position, lack of organic staining, and pronounced pedogenic expression in the paleosol are indicative of its greater chronological age. The soil morphological expressions appear to be relic features of previous soilscapes that were subsequently buried by fluvial sediments.

CHEMICAL DESCRIPTION

Calcium and hydrogen (acidity) were the dominant exchangeable cations (Table 63). Calcium contents varied in different levels with maximum values occurring at depths of 75-87 cm (29.5-34.3 in) in the pedon analyzed and decreasing with depth. Calcium levels were three to four times greater than levels off-site in the adjacent floodplain. Ca/Mg ratios exceeded 8:1 throughout the pedon, with values generally decreasing with increasing depth except in the surface layer. Potassium levels were much higher in the surface layer, with a second maxima occurring at depths of 51-97 cm (20.1-38.2 in). Trace levels of sodium were present as might be expected in the highly leached environment. Exchangeable aluminum levels increased dramatically in the underlying paleosol, with maximum values occurring at depths of 180-200 cm (70.9-78.8 in). Higher exchangeable aluminum values are generally associated with intense weathering and reflect age. Cation exchange capacities were greater in the upper layers reflecting the higher organic matter contents. Base saturation levels increased with depth, and they were much greater than levels of adjacent floodplain soils.

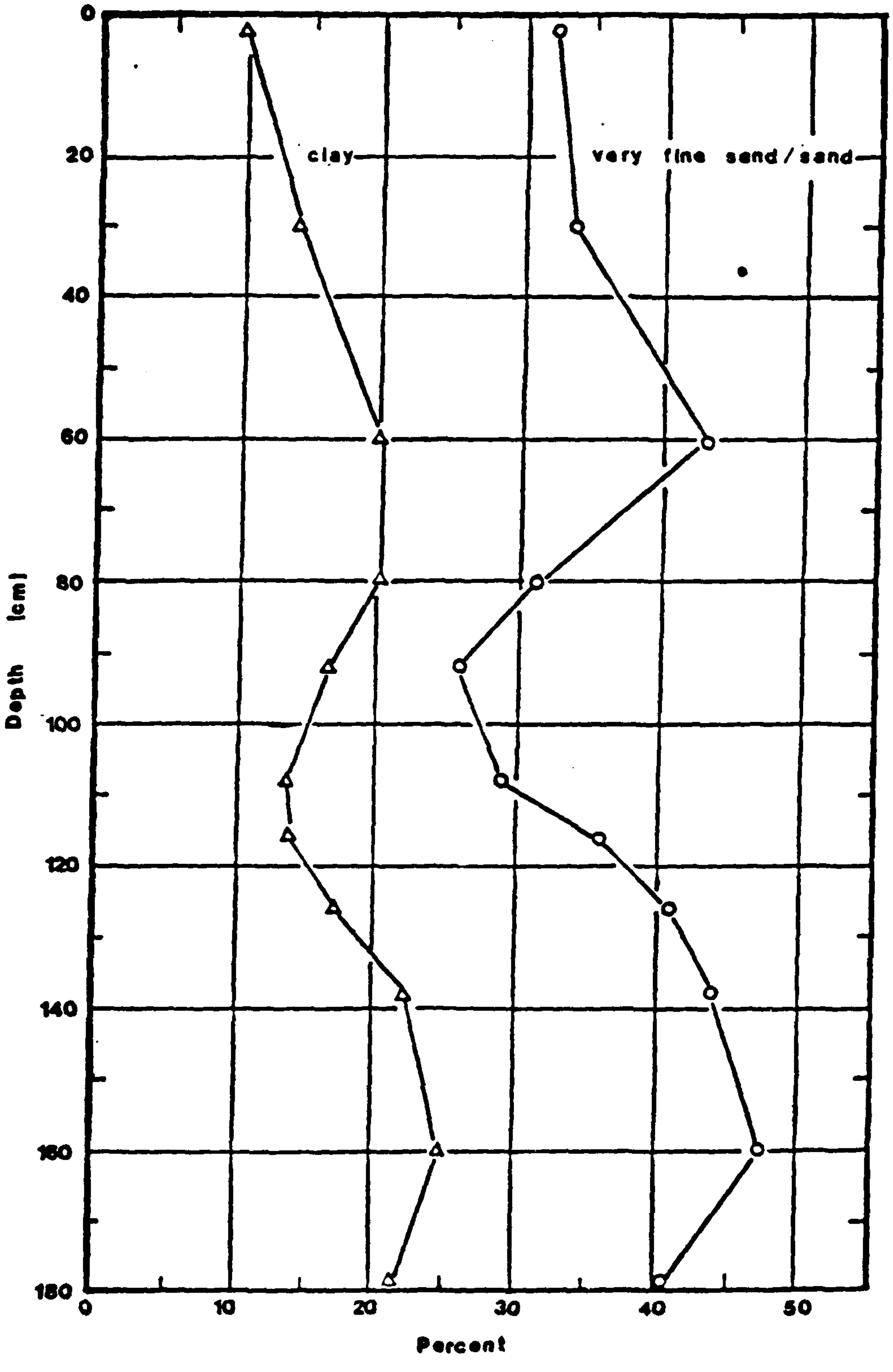


Figure 35 Constant sand fabric, 22It576.

TABLE 63
Chemical characteristics of representative pedon, 22It576.

		Exchangeable Cations							
Depth	pH	Ca	Mg	K	Na	H	Al	Total	Base Saturation
cm		------------Cmol (p+) kg-1------------							
0 - 10	5.3	11.32	1.28	0.42	0.03	15.54	0.09	28.59	45.65
10 - 51	6.0	12.48	0.84	0.09	0.03	11.45	0.03	24.89	54.00
51 - 75	5.7	12.90	0.83	0.10	0.04	12.46	0.15	26.33	52.68
75 - 87	5.8	15.00	0.69	0.14	0.03	12.18	0.05	28.04	56.56
87 - 97	6.0	9.34	0.48	0.11	0.04	7.28	0.04	17.25	57.80
113 - 120	6.1	8.62	0.48	0.08	0.03	6.49	0.00	15.70	58.66
120 - 130	6.1	8.49	0.48	0.09	0.03	6.72	0.04	15.81	57.50
130 - 146	5.7	8.61	0.60	0.07	0.04	6.64	0.45	15.96	58.40
146 - 184	5.4	8.99	0.70	0.09	0.04	8.52	1.53	18.34	53.54
184 - 200	5.3	10.00	0.85	0.10	0.07	8.94	1.91	19.96	55.21
200 - 230	5.3	8.86	0.82	0.09	0.06	6.34	0.88	16.17	60.79

Soil pH levels varied with depth (Table 63). Highest pH values occurred at depths of 87-130 cm (34.3-51.2 in), and they were associated with lower exchangeable acidity. The soil pH levels in the site were considerably higher than adjacent floodplain soils, which had average values of 4.8. The higher pH values of the site are associated with higher exchangeable calcium and lower acidity levels.

Organic matter levels generally tended to be greatest in the surface horizons (Tables 64 and 65). However, levels exceeding 3.5% were detected in the 50-60 cm (19.7-23.6 in) layer of Block D, which indicates the variation across the site. Organic matter levels exceeded 1% in the upper 80 cm (31.5 in) and coincided with the dark reddish brown 5YR hues. Total nitrogen levels also decreased with depth and did not correspond to increased organic matter levels that occurred at various depths. This suggests a depletion of N or concentration of C. This trend is also reflected in the C/N ratio which increases below the surface layer and does not substantially decrease until depths of 80 cm (31.5 in) and greater. The large C/N ratios are due to the relatively low levels of N compared to C, which suggest concentration of C and/or depletion of N. The C/N ratio of natural, non-disturbed soils of the region ranges from 10 or 12/1 and decreases with depth. The high C/N ratios and presence of appreciable amounts of C in deeper layers is a sharp contrast to undisturbed soils of the region. It is interesting to note that the Munsell color hue does not change with these variations, and little change was noted in chroma and value. The paleosol had organic matter levels less than 0.5%. Free iron oxide contents (Fe_2O_3), shown in Table 65 exceeded 3% in the upper 50 cm (19.7 in) and decreased abruptly before increasing again in the paleosol. The Fe_2O_3 levels in the paleosol are similar to levels occurring in argillic horizons of adjacent upland Hapludults. Higher Fe_2O_3 levels are generally associated with higher clay contents in soils of the area. However, clay contents of the surface horizons were less than deeper horizons, posing an enigma for the higher levels detected in the surface layers.

TABLE 64

Organic matter, carbon, nitrogen contents, carbon/nitrogen ratio, and 1% citric acid soluble P205 contents of representative pedon of Block D, 22It576.

Level	Depth (cm)	Organic Matter (%)	C (%)	N (%)	C/N	1% Citric Acid Soluble P205 (ppm)
1	0 - 10	2.75	1.59	0.109	14.5/1	466.6
2	10 - 20	1.83	1.06	0.047	22/1	500.0
3	20 - 30	2.29	1.33	0.051	26/1	934.6
4	30 - 40	2.27	1.31	0.041	31.9/1	627.7
5	40 - 50	2.43	1.41	0.043	32.8/1	771.7
6	50 - 60	3.53	2.05	0.046	44/1	1,230.4
7	60 - 70	2.61	1.51	0.052	29/1	2,116.2
8	70 - 80	1.59	0.92	0.042	22/1	1,603.3
9	80 - 90	0.98	0.57	0.031	18.4/1	838.4
10	90 - 100	0.81	0.47	0.030	15.7/1	920.2
11	100 - 110	0.47	0.27	0.030	9/1	774.7
12	110 - 120	0.27	0.16	0.028	5.7/1	634.6

TABLE 65

Organic matter and Fe203 contents of typical pedon, 22It576.

Depth (cm)	Organic Matter (%)	Fe203 (%)
0 - 10	3.16	3.7
10 - 51	1.77	3.0
51 - 75	1.53	2.0
75 - 87	1.90	2.0
87 - 97	0.74	1.4
97 - 113	0.77	0.7
113 - 120	0.50	1.3
120 - 130	0.23	1.5
130 - 146	0.23	1.8
146 - 184	0.21	2.0
184 - 200	0.12	1.4

Anthropic epipedons are required to have at least 250 ppm P_20_5 extractable in 1% citric acid in addition to definitive color and organic matter contents (Soil Taxonomy 1965). All the layers analyzed in the Block D pedon had P_20_5 levels well above 250 ppm (Table 66). Maximum values occurred at depths of 50-80 cm (19.7-31.5 in), and the levels were much higher than layers above and below these depths. The higher levels at these depths may be indicative of greater population, habitation time, or other activities when the layers at 50-80 cm (19.7-31.5 in) were the antecedent surface horizon. In comparison, citric acid extractable P_20_5 levels of adjacent off-site soils were less than 120 ppm for selected soil samples analyzed.

TABLE 66

Soil phosphorus fractions of representative profile from Block D, 22It576.

		Phosphorus Fractions				
Level	Depth (cm)	Non-Occluded	Occluded	Calcium	Organic	Total
		ppm				
1	0 - 10	794	659	95	71	1,619
2	10 - 20	630	459	36	34	1,159

TABLE 66
Soil phosphorus fractions of representative profile from Block D, 22It576 (continued).

		Phosphorus Fractions				
Level	Depth (cm)	Non-Occluded	Occluded	Calcium	Organic	Total
		ppm				
3	20 - 30	804	614	201	34	1,652
4	30 - 40	768	304	32	28	1,132
5	40 - 50	838	550	31	29	1,448
6	50 - 60	809	749	208	29	1,796
7	60 - 70	926	851	338	35	2,149
8	70 - 80	1,007	314	173	30	1,523
9	80 - 90	714	323	9	23	1,069
10	90 - 100	944	225	9	26	1,204
11	100 - 110	814	295	4	21	1,133
12	110 - 120	831	349	4	21	1,205

Phosphorus is one of the least mobile soil constituents. However, under intense weathering conditions with warm temperatures and excess precipitation, or over long periods of time, soil phosphorus undergoes changes in chemical form and location in the profile (Walker and Syers 1976). The levels of various soil phosphorus fractions have been used to quantify soil development and chronological age relationships (Walker 1964). Research in New Zealand (Walker and Syers 1976) showed the soil phosphorus transformations consisted of the dissolution of calcium phosphates and the formation of organic and aluminum and iron-oxide phosphorus species. They reported that with pedogenesis all forms of soil phosphorus were transformed almost completely to the organic and occluded forms. The phosphorus fractions extracted by sequential laboratory extractions in these studies were grouped into functional P fractions. These groupings consisted of non-occluded P (Pnoc) which has been associated with aluminum and iron oxide surfaces and is readily available for plant use; occluded P (Poc) which has been associated with aluminum and iron-oxide lattices and is not readily available for plant use except under a reduced environment; calcium-bound P which is considered not to be readily available for plant use. Meixner and Singer (1985) studied phosphorus fractions from soil profiles formed in mixed alluvium in California of a chronosequence ranging in age from 300-250,000 years. They reported that occluded phosphorus (Poc) generally increased, and the content of non-occluded phosphorus (Pnoc) decreased in B horizons. They found that calcium-bound phosphorus (Pca) decreased over time in the surface horizons, but changed little in B horizons. In this study, the organically bound phosphorus (Po) did not change with time.

The discrete soil phosphorus fractions determined by sequential laboratory extractions for a representative pedon from 22It576 are presented in Table 66. Organic P levels have been used widely in archaeological studies (Griffith 1980) and related to human occupation. It is interesting to note that maximum values of non-occluded, occluded calcium, and total phosphorus occur at depths of 50-70 cm (19.7-27.6 in), and maximum values for occluded phosphorus occur at depths of 90-100 cm (35.5-39.4 in). These data seem to indicate greater additions of phosphorus materials from occupation that occurred when this layer was the exposed surface of occupation. It may be depictive of a long period of occupation or larger population on this occupational surface. The organic phosphorus levels remain relatively low to depths of 120 cm (47.3 in).

The non-occluded phosphorus fraction, which has been associated with aluminum and iron oxide surfaces, was the dominant fraction (Table 67). Occluded phosphorus comprised less than 42% of the total. The organic phosphorus fraction contents ranged from 4.3% in the surface layer to 1.9% at a depth of 110-120 cm (43.3-47.3 in). The literature suggests PCa contents might be expected to decrease with time as weathering releases P from this fraction for conversion to other forms. The PCa levels did not exhibit a steady decrease until depths below 80 cm (31.5 in).

TABLE 67
Soil phosphorus fractions percentage of total phosphorus content of representative profile from Block D, 22It576.

		Phosphorus Fractions			
Level	Depth (cm)	Non-occluded (Noc)	Occluded (Oc)	Calcium (Ca)	Organic (O)
		percentage			
1	0 - 10	49.0	40.7	5.9	4.3
2	10 - 20	54.3	39.6	3.1	3.0
3	20 - 30	48.6	37.1	12.2	2.1
4	30 - 40	67.8	26.8	2.8	2.6
5	40 - 50	57.8	37.9	2.2	2.1
6	50 - 60	45.0	41.7	11.6	1.7
7	60 - 70	43.1	39.6	15.7	1.6
8	70 - 80	66.1	20.6	11.3	2.0
9	80 - 90	66.7	30.2	0.9	2.2
10	90 - 100	78.4	18.7	0.7	2.2
11	100 - 110	71.8	26.0	0.3	1.9
12	110 - 120	68.9	28.9	0.3	1.9

MINERALOGICAL DESCRIPTION

Kaolinite was the dominant clay mineral with lesser amounts of illite, vermiculite-chlorite integrade, smectite, and quartz. The different layers did not exhibit dissimilar mineral suites, but had a high degree of similarity as might be expected, since they had a common fluvial parent material. However, vermiculite-chlorite integrade contents decreased with depth, and it was not detected in the underlying paleosol horizons. The absence of chlorite-vermiculite in the paleosol relative to the superjacent horizons suggests greater weathering in the paleosols. This finding agrees with data of Ruhe et al. (1974), who studied paleosols in Indiana.

The sand and silt fractions were dominated by quartz with lesser amounts of mica, glauconite, and feldspar.

MICRO-MORPHOLOGICAL DESCRIPTION

Examinations of natural soil peds and separated sand fractions were done for selected samples via conventional light microscopy. Representative samples of the dark-colored, humic-stained upper layers and subjacent paleosol layers were examined in detail.

EPIDEDON

The skeletal matrix (sand and silt) was comprised dominantly of sand grains which were uniformly coated with reddish brown and black organic matter. The individual coated sand grains were bound or cemented by humus into clusters or domains which formed moderate to strong granular structure. The structural aggregates tended to wet very slowly, initially repelling the introduced water, suggesting a high capillary contact angle. The structural units were resistant to disruption by water and persisted when repeatedly immersed in water and dried. The organic coating was not removed by prolonged shaking in water. Shaking the soil in 0.05 N NaOH removed the humus coating revealing angular and rounded, clear quartz grains. The sand grains became loose and single grained after removal of the organic coating, and they tended to re-wet readily. The epipedon of the midden mound presented a striking contrast in comparison to adjacent non-site floodplain soils. The adjacent soils had very thin (0-6 cm/0-2.4 in) surface layers that were not as dark colored with Munsell hues of 10YR, and they had a "salt and pepper" appearance due to uncoated white quartz grains and unbound black organic detrius. The non-site soils had much less defined structural units and tended to wet more readily. The organic-stained epipedon materials had a distinctive smooth or "greasy" feel when rubbed between the fingers in contrast to a coarse feel for the non-site soils.

Additional tests were conducted to characterize further the nature of the humus coating. Immersion of the humic-stained soil in H_2O for 12 hours with shaking resulted in no unbound or "free" organic matter, and the structural domains persisted. Treatment of the epipedon with 0.5 N NaOH and gentle shaking readily removed the humus coating and resulted in a reddish brown extract. Addition of 0.5 N HCl to the colored extract resulted in complete flocculation of the organic material leaving a clear supernatant indicating dominantly humic acid compounds (McKeague 1968). The color ratio of the 0.5 N NaOH extract solutions was determined to characterize further the coating materials. The color ratio has been expressed as:

$$E4/E6 = \frac{\text{extinction (absorbance) at 400 nm}}{\text{extinction (absorbance) at 600 nm}}$$

and it has been used for differentiation of humic substances (Tan 1982). Fulvic acids yield spectra with a steep slope in contrast to humic acids. According to research by Tan (1982), a low color ratio less than seven corresponds to humic acids and related compounds with high molecular weights. A color ratio value greater than seven generally corresponds to fulvic acid groups.

PALEOSOL

Microscopic examinations revealed the paleosols commonly have a fine-grained S-matrix with void argillans and embedded grain argillans dispersed throughout the matrix. Voids tended to be smaller in the paleoargillic horizons than existed in the overlying epipedons. The paleosol horizons had a high content of vesicular pores that were not connected. The paleosol had compound structure with prismatic parting to well-developed subangular blocky structure. The polygonal seams between prisms were highly leached and stripped of fines.

Color ratio values for the representative pedon of Block D (Table 68) indicate dominantly humic acid compounds. Values gradually increased with depth but were less than seven.

TABLE 68
Color ratio values of NaOH extracts of representative pedon from Block D, 22It576.

Level	Depth (cm)	Color Ratio Value= $\frac{\text{absorbance 400 nm}}{\text{absorbance 600 nm}}$
1	0 - 10	3.73
2	10 - 20	3.83
3	20 - 30	4.04
4	30 - 40	3.89
5	40 - 50	3.83
6	50 - 60	3.68
7	60 - 70	3.95
8	70 - 80	4.34
9	80 - 90	4.47
10	90 - 100	4.64
11	100 - 110	5.44
12	110 - 120	6.36

SUMMARY

Site 22It576 occupied a topographic high in the eastern part of the Tombigbee River floodplain about 300 m (990 ft) west of the Pleistocene valley wall. Part of the site floods during winter and spring months. The upper meter (3.3 ft) of the site is dark reddish brown with Munsell hues of 5YR, and it has loamy textures. Organic matter contents exceed 1% in the upper meter (3.3 ft) and decrease with depth. The dark upper strata are underlain by a lighter colored paleosol which contains a paleoargillic horizon. Maximum clay contents occur in the paleosol, which has well-developed structural aggregates and macro-structure expressed by a distinctive polygonal network, with polygons separated by seams of leached silt and sand. The thickness and pedogenic development of the paleosol suggest landscape stability and soil formation over a substantial time interval prior to burial. There was no evidence of the ancestral surface horizon of the buried paleosol, which suggests fluvial truncation may have occurred prior to subsequent burial.

Calcium and hydrogen (acidity) were the dominant exchangeable cations. Calcium levels were much higher than adjacent off-site soils, and contents varied in the different horizons. Potassium levels were highest in the surface horizon with a second maximum occurring at depths of 51-97 cm (20.1-38.2 in). Trace levels of sodium were detected. Exchangeable aluminum increased in the underlying paleosol suggesting greater weathering and age. Soil pH values ranged from 5.8 in the surface to 6.0 and greater at depths of 87-130 cm (34.3-51.2 in) before decreasing with depth. Soil pH levels were higher than off-site soils.

Total nitrogen levels decreased with depth and did not correspond to increased organic carbon levels at different depths. The site had very high C/N ratios ranging as high as 44/1 at depths of 50-60 cm (19.7-23.6 in). A very large increase in citric acid soluble P_2O_5 occurred at depths of 50-80 cm (19.7-21.5 in). Citric acid (1%) soluble P_2O_5 levels exceeded 460 ppm throughout the sola. These levels are several hundred fold greater than values of adjacent off-site soils and reflect cultural additions. Maximum organic phosphorus levels occurred at depths of 50-70 cm (19.7-27.6 in). The site soil contained calcium phosphorus fractions ranging to 338 ppm at 60-70 cm, which is unusual in the highly leached environment and also reflects cultural additions.

Kaolinite was the dominant aluminum phyllosilicate clay with lesser amounts of illite, vermiculite-chlorite integrade, smectite, and quartz. The sand and silt fractions were dominated by quartz with lesser amounts of mica, glauconite, and feldspar. The different layers did not exhibit dissimilar mineral suites.

The upper meter (3.3 ft) skeletal matrix (sand and silt) was comprised of sand grains uniformly coated with reddish brown and black humus which imparted structural stability to the soil characterized by granular structure that persisted against repeated wetting and drying. Analyses indicated the amorphous humus coating material was comprised dominantly of humic acid compounds.

THE ILEX SITE (22It590)

The Ilex site was located on a low fluvial terrace at the juncture of the southern valley wall and floodplain of Mackey's Creek. The nearly level terrace appeared to have been joined to the Pleistocene ridge to the south prior to lateral dissection by fluvial actions. The site was 2-3 m (6.6-9.9 ft) above the active floodplain, and it had a slope of 0-3%.

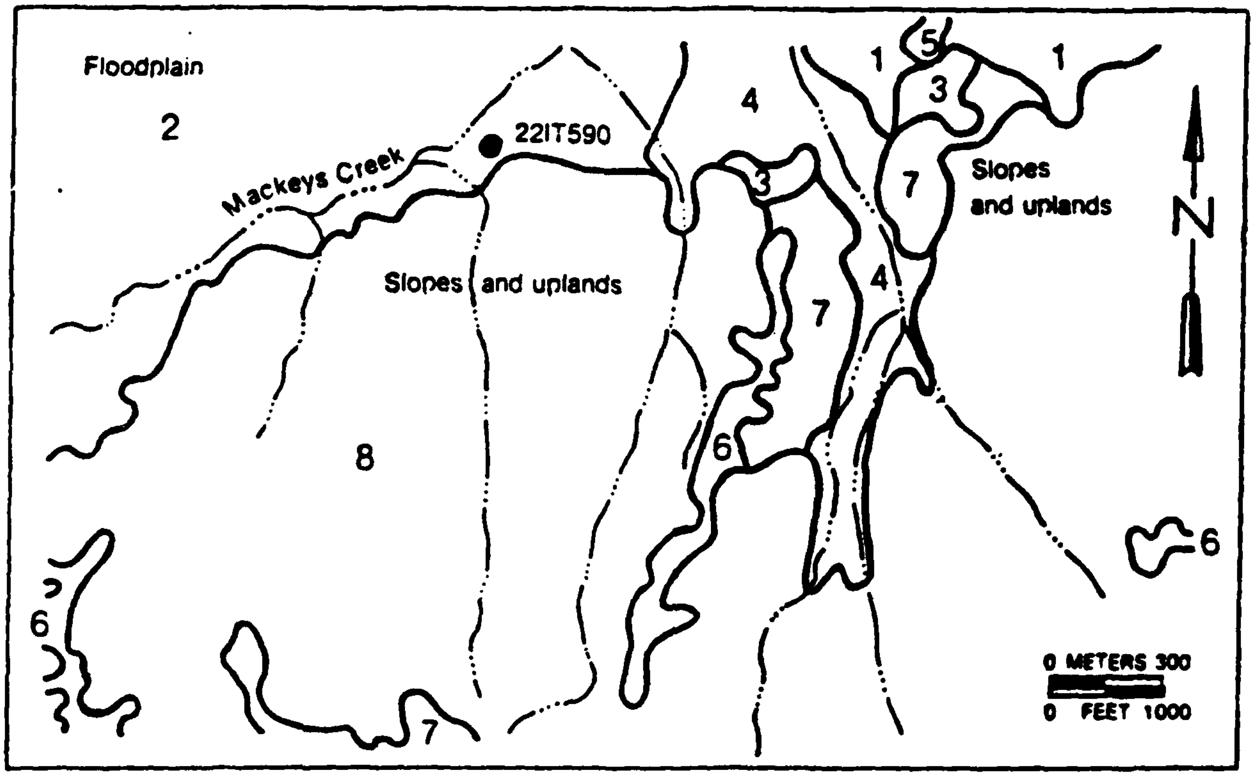
The terrace deposits appeared to be a combination of fluvial sediments and colluvium/alluvium moved downslope from the adjacent Pleistocene sideslopes. Although covered with forest vegetation, the steep sideslopes exhibited many slippage areas.

Steep valley walls with slopes of 25-50% adjoin the site to the south. Mature, well-developed soils with distinct E horizons and illuviated argillic horizons comprised the upland areas. Dominant soils were mapped as the Smithdale association, hilly (Figure 35). Smithdale soils had red subsoils that contained up to 35% clay in the argillic horizons. The upland soils were highly weathered, strongly acid, and siliceous with low base saturation levels (Ultisols).

Kirkville and Mantachie soils comprised the Mackey's Creek floodplain bounding the site. These soils had minimal pedogenic development and had cambic (Bw) horizons with little eluviation and illuviation. They were strongly acid, and surface horizons exhibited scouring and deposition from recent fluvial action. These soils had brown and yellowish brown surfaces with Munsell hues of 10YR, and gray, light gray, or pale brown subsoils with loamy textures.

The culturally altered soils of the site developed in loamy, siliceous sediments. These soils were readily distinguished by the thick, dark reddish brown, humus-stained epipedons which resulted from prolonged occupation and cultural activities. Past occupation of the site had drastically modified normal pedogenic features of color, horizonation, organic matter content, and other parameters. The soils comprising the upper meter of the site were distinctly different from adjacent undisturbed soils which had thin surface horizons and Munsell hues of 10YR.

Large populations of earthworms, crawfish, rodents and other diverse microfauna and microflora thrived in the organic-rich mound. The site elevation above the adjacent floodplain of Mackey's Creek provided an excellent habitat for diverse biota. Extensive bioturbation and recent digging by artifact hunters had tended to mix the upper meter (3.3 ft) of the site and had retarded normal pedogenic development.



SOIL LEGEND

SYMBOL	NAME
1	Harleston fine sandy loam
2	Kirkville-Mantachie
3	Lexington silt loam, 2 to 5 percent
4	Mantachie loam
5	Mathiston silt loam
6	Smithdale fine sandy loam, 5 to 8 percent
7	Smithdale fine sandy loam, 8 to 17 percent
8	Smithdale association, hilly

Figure 36 Soils in the vicinity of 22It590.

PHYSICAL DESCRIPTION

The upper meter (3.3 ft) of the site soil was dark reddish brown and dark brown (Table 69) with moist hues of 5YR and 7.5YR, respectively. These colors differed from adjacent undisturbed soils which had thin surface horizons with 10YR hues. The mound soil epipedon had a Munsell value which changed at least one unit from wet to dry, which was in sharp contrast to adjacent soils that did not exhibit this color change. The dark reddish brown epipedon had a distinct "greasy" or slick feel when rubbed between the fingers. The upper horizons had granular structure and friable consistence. Subsoil colors of the site soils were brownish yellow to light yellowish brown with 10YR hues. In places, horizontal lamellae occurred in the deeper strata parallel to the surface. The lamellae had higher clay contents and were usually brighter in color. These layers may represent periods of landscape stability and pedogenesis, or represent water table fluctuations.

TABLE 69
Pedon description of representative profile, 22It590.

Depth (cm)	Description (moist colors)
0-15	Dark reddish brown (5YR3/2) loamy sand; weak fine granular structure; friable; sand bridging by humus; common fine and medium roots; common charcoal fragments; gradual wavy boundary.
15-30	Dark reddish brown (5YR2.5/2) sandy loam; weak fine granular structure; friable; intergranular bridging by humus coating; common fine and medium roots; common krotovinas and worm casts; few charcoal fragments; gradual wavy boundary.
30-50	Dark reddish brown (5YR3/2) sandy loam; weak fine granular structure; friable; common fine roots; gradual wavy boundary.
50-59	Dark reddish brown (5YR3/2) sandy loam with few fine faint mottles of light yellowish brown (10YR6/4); weak fine granular structure; friable; common fine roots; clear wavy boundary.
59-69	Dark brown (7.5YR3/2) sandy loam; weak fine granular structure; friable; few fine black fragments (10YR2/1) in lower part of horizon.
69-79	Dark brown (7.5YR4/2) sandy loam with common fine faint brown mottles (7.5YR4/4); weak fine structure; slightly firm in place, friable when disturbed; common vesicular pores oriented perpendicular to vertical direction; common black charcoal fragments; gradual wavy boundary.
79-116	Dark brown (7.5YR4/2) sandy loam with common fine and medium faint mottles of strong brown (7.5YR5/6), and reddish yellow (7.5YR6/8); weak fine subangular blocky structure; firm in place, slightly friable when disturbed; many vesicular pores oriented perpendicular to the vertical direction; common black charcoal; gradual wavy boundary.

TABLE 69

Pedon description of representative profile, 22It590 (continued).

Depth (cm)	Description (moist colors)
116-144	Light yellowish brown (10YR6/6) loamy sand; massive in place, breaks to single grain when disturbed; loose; sand grains commonly stripped of coatings; slightly firm in place; clear wavy boundary.
144-203	Brownish yellow (10YR6/6) loam with common medium distinct mottles of yellow (10YR7/8); yellowish brown (10YR5/8) and strong brown (7.5YR5/8); massive in place, parting to weak fine subangular blocky structure when disturbed; no evidence of cultural alteration; gradual wavy boundary.
203-232	Mottled yellow (10YR7/6) and pale brown (10YR6.3) loamy sand; single grain; loose; no evidence of cultural alteration.

Particle size distributions (Tables 70 and 71) reflect textural stratification resulting from different fluvial depositions and perhaps reworking action. Textures ranged from sand to loam. There was some textural variation across the site as shown by data. Sand contents were higher on the southern part of the site adjoining the steep sandy slopes of the Pleistocene valley wall. The sand fraction was dominated by fine sand (0.25-0.10 mm) and medium sand (0.5-0.25 mm). The fine-sand fraction was higher on the southern portions of the site adjacent to the uplands. Silt contents tended to be greater in the center and northern portions of the site. Clay contents were variable with maximum levels ranging to 15%. There was little evidence of illuviation.

TABLE 70

Particle size distribution of selected soil samples representative, 22It590.

Depth cm	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Texture
0-15	81.7	13.7	4.6	loamy sand
15-30	70.9	21.7	7.4	sandy loam
30-50	70.8	22.9	6.3	sandy loam
50-59	69.2	22.5	8.3	sandy loam
59-69	74.2	16.2	9.6	sandy loam
69-79	68.0	20.4	11.6	sandy loam
79-116	64.9	20.4	14.7	sandy loam
116-144	81.4	14.0	4.6	loamy sand
144-203	46.0	38.6	15.4	loam
203-323	83.5	8.9	7.6	loamy sand

Sand Fraction

Depth cm	Very Coarse (2-1 mm)	Coarse (1-.5 mm)	Medium (.5-.25 mm)	Fine (.25-.10 mm)	Very Fine (.10-.05 mm)
			percentage		
0-15	3.70	16.70	32.50	25.40	3.40
15-30	.10	.40	17.50	44.10	8.80
30-50	.03	.30	17.30	44.50	8.70

TABLE 70
Particle size distribution of selected soil samples representative, 22It590. (continued).

Sand Fraction

Depth	Very Coarse (2-1 mm)	Coarse (1-.5 mm)	Medium (.5-.25 mm)	Fine (.25-.10 mm)	Very Fine (.10-.05 mm)
cm	percentage				
50-59	.04	.20	18.50	42.90	7.60
59-69	.04	.20	22.40	45.50	6.00
69-79	.10	.30	18.70	41.70	7.20
79-116	.03	.30	17.40	39.60	7.60
116-144	.04	.40	24.20	50.40	6.40
144-203	.10	1.40	14.10	25.20	5.20
203-232	.03	.30	41.70	38.90	2.60

TABLE 71
Particle size distribution of representative soil pedon at the edge of Site 22It590.

Depth	Sand (2-0.05mm)	Silt (0.05-0.002mm)	Clay (<0.002 mm)	Texture
cm	percentage			
0-7	88.4	6.4	5.2	sand
7-12	89.3	5.7	5.0	sand
12-20	88.7	6.5	4.8	sand
20-75	86.8	3.4	10.2	loamy sand
75-97	84.5	7.9	7.6	loamy sand
97-140	85.6	11.0	3.9	loamy sand

Sand Fraction

Depth	Very Coarse (2-1 mm)	Coarse (1-.5 mm)	Medium (.5-.25 m)	Fine (.25-.10 m)	Very Fine (.10-.05mm)
cm	percentage				
0-7	0.6	0.3	15.2	63.3	9.0
7-12	0.4	0.4	16.3	63.9	8.3
12-20	0.2	0.3	14.7	64.6	8.9
20-75	0.1	3.1	18.1	62.4	3.2
75-97	0.2	0.6	25.7	52.5	5.5
97-140	0.1	0.1	23.7	53.4	7.8

CHEMICAL DESCRIPTION

Calcium and hydrogen (acidity) were the dominant exchangeable cations (Tables 72 and 73). Calcium contents varied across the site with lower values occurring on the southern part of the site. In the representative site pedon (Table 72), calcium levels varied with depth, and maximum values occurred at depths of 69-116 cm (27.2-45.7 in). The calcium levels were several hundred fold higher than undisturbed adjacent soils. Ca/Mg ratios varied with depth and across the site. Potassium levels were highest in the surface layers. Trace levels of sodium were present. A large increase in exchangeable aluminum occurred at depths of 20-75 cm (7.9-29.5 in) in the pedon on the southern portion of the site (Table 73).

TABLE 72
Chemical characteristics of representative pedon, 22It590.

				Exchangeable Cations					Base
Depth	pH	Ca	Mg	K	Na	H	Al	Total	Saturation
cm				cmol (p+) kg-1					- % -
0-15	4.9	2.58	0.37	0.26	0.04	9.93	0.61	13.18	24.6
15-30	5.7	5.37	0.59	0.07	0.02	8.09	0.01	14.14	42.7
30-50	5.8	6.34	0.42	0.05	0.03	6.49	0.01	13.33	51.3
50-59	5.8	5.99	0.55	0.04	0.03	6.49	0.00	13.55	48.7
59-69	5.6	6.72	0.66	0.05	0.04	5.79	0.01	13.26	56.3
69-79	5.7	8.72	0.80	0.07	0.03	6.79	0.01	16.41	58.6
79-116	5.6	9.47	0.56	0.05	0.03	8.27	0.07	18.38	55.0
116-144	5.7	3.40	0.21	0.04	0.02	3.06	0.03	6.73	54.5
144-203	5.5	8.10	0.72	0.14	0.04	3.90	0.42	12.90	69.7
203-232	5.6	5.90	0.47	0.11	0.03	2.33	0.27	8.84	73.6

TABLE 73
Chemical characteristics of representative soil pedon at the edge of Site 22It590.

				Exchangeable Cations					Base
Depth	pH	Ca	Mg	K	Na	H	Al	Total	Saturation
(cm)				cmol (p+) kg-1					- % -
0-7	5.3	2.63	0.74	0.15	0.01	5.23	0.54	8.76	40.3
7-12	5.5	2.36	0.74	0.12	0.02	4.83	0.59	8.07	40.1
12-20	5.3	1.76	0.71	0.10	0.02	4.35	0.80	6.94	37.3
20-75	4.8	1.19	0.63	0.08	0.02	6.79	3.23	8.71	22.0
75-97	4.9	0.48	0.81	0.08	0.02	5.25	2.56	6.64	20.9
97-140	5.2	1.01	0.59	0.04	0.02	1.50	0.53	3.16	52.5

The exchangeable aluminum contents were similar to levels occurring in the subsoils of adjacent upland soils, suggesting similar materials. Cation exchange capacities (Table 73) were greater in the representative pedon on the site (Table 72) suggesting possible differences in mineralogy. Base saturation exceeded 40% except for the surface 0-15 cm (0-5.9 in) in the representative pedon.

Soil pH levels varied with depth and distance across the site (Tables 72 and 73). Values were slightly higher than adjacent undisturbed soils.

Organic matter contents were greatest in the surface horizons. However, variations occurred with distance across the site (Table 74). Organic matter exceeded 1% in the upper meter (3.3 ft) and tended to coincide with the darker color. Total nitrogen levels decreased with depth. The C/N ratios tended to increase with depth, and decreased at one meter (3.3 ft). P_2O_5 levels (soluble in 1% citric acid) exceeded 250 ppm in the upper 60 cm (23.6 in) of the pedon analyzed, with levels decreasing with depth to 184 ppm at 100 cm (39.4 in) (Table 75). The total and organic phosphorus distribution was variable and difficult to interpret (Table 76). Free iron-oxide contents exceeded 1% in the upper meter (3.3 ft) with maximum values occurring at 69-79 cm (27.2-31.1 in).

TABLE 74
Organic matter, carbon, nitrogen contents, carbon/nitrogen ratio, and 1% citric acid soluble P205 contents of representative pedon Block A-Z, 22It590.

Level	Depth	Organic Matter	C	N	C/N	1% Citric Acid Soluble P205
	-cm-	percentage				ppm
2	10-20	1.10	0.64	0.047	13.6/1	509.6
3	20-30	1.13	0.65	0.032	20/1	508.6
4	30-40	1.17	0.68	0.025	27/1	467.9
5	40-50	1.27	0.74	0.024	30.8/1	428.5
6	50-60	1.48	0.86	0.022	39/1	388.9
11	100-110	0.38	0.22	0.018	12/1	184.43

TABLE 75
Organic matter, free iron oxide, total and organic phosphorus contents and pH of representative pedon, 22It590.

Depth	Organic Matter	Fe203	Total P	Organic P	pH
cm	percentage		ppm		
0-15	3.00	1.23	353.5	117.0	4.9
15-30	1.25	1.65	230.8	21.0	5.7
30-50	1.33	1.51	427.7	158.4	5.8
50-59	1.53	1.65	277.2		5.8
59-69	1.13	1.65	250.8	10.7	5.6
69-79	1.20	2.17	184.2		5.7
79-116	1.40	1.97	286.7	109.9	5.6
116-144	0.36	0.67	267.0	178.0	5.7
144-203	0.10	1.08	110.5	20.5	5.5
203-232	0.07	0.58	58.5		5.6

TABLE 76
Organic matter, carbon, total nitrogen contents and carbon/nitrogen ratio of representative pedon, 22It590.

Depth	Organic Matter	C	N	C/N
cm	percentage			
0-15	2.75	1.59	0.172	9.2/1
15-37	0.73	0.42	0.047	8.9/1
37-60	0.96	0.56	0.035	16.0/1
60-100	1.38	0.80	0.032	25.0/1
100-150	1.03	0.60	0.029	20.7/1
150-180	0.46	0.27	0.023	11.7/1
180-195	0.09	0.05	0.012	4.2/1
195-250	0.06	0.03	0.011	2.7/1
250-275	0.08	0.05	0.014	3.5/1

MINERALOGICAL DESCRIPTION

Kaolinite was the dominant clay mineral with lesser amounts of illite, vermiculite-chlorite integrade, smectite and quartz. Trace amounts of smectite were detected in the clay fractions of the materials from 0-30 cm (0-11.8 in). However, smectite contents increased with depth and reached maximum levels between 69-144 cm (27.2-56.7 in) depth. Sand and silt fractions were dominantly quartz with trace amounts of mica, glauconite, and feldspar.

SUMMARY

Site 22It590 was located on a low terrace at the juncture of the southern valley wall and floodplain of Mackey's Creek. The site was 2-3 m (6.6-9.9 ft) above the active floodplain, and it had a slope of 0-3%. The site soil was distinguished by thick, humus-rich dark reddish brown loamy sand and sand upper layers. The dark-colored epipedon had Munsell colors of 5YR which contrasted with adjacent off-site soils which had thin surface horizons with 10YR colors. Sand contents were higher on the southern part of the site adjoining the steeply sloping Pleistocene uplands. Little evidence of clay illuviation was detected in the site soil. The dark-colored surface layers graded to lighter colored subsoils with 7.5YR and 10YR colors. Organic matter contents were greater in the surface horizons and exceeded 1% in the upper meter (3.3 ft).

Calcium and hydrogen (acidity) were the dominant exchangeable cations of the site soil. Calcium levels were enriched in the site soil well above levels of adjacent undisturbed soils. Calcium levels tended to decrease with distance from the center of the site. Potassium levels were highest in the surface layers of the site soil. Increased levels of exchangeable aluminum occurred in subsoil layers in the southern edge of the site bounding the steep uplands, suggesting similarities in soil parent materials. Trace levels of sodium were detected with no accumulations. Soil pH varied with depth and location in the site and was slightly higher than adjacent soils.

Total nitrogen levels decreased with depth. The C/N ratios varied with depth and differed from adjacent soils. Soil horizons in the upper 60 cm (23.6 in) of the site contained greater than 250 ppm citric acid (1%) soluble P_2O_5, which is one criteria for anthropic epipedons. Total and organic phosphorus distribution was variable and difficult to interpret.

Kaolinite was the dominant mineral in the clay fraction with lesser amounts of illite, vermiculite-chlorite integrade, smectite, and quartz. Smectite contents increased at depths below 30 cm (11.8 in).

SITE 22IT606

The site is located in an upland position on a Pleistocene terrace which has been incised by the Tombigbee River and Mud Creek. The mature landscape had been partially isolated on the east, south, and west resulting in a peninsula-shaped surface (Figure 37). The incision resulted in steep-sided slopes with a pronounced escarpment on the southern terminus. The surface was located above the floodprone area of the Tombigbee River, and it was not subject to flooding. Recent cultivation and occupation of the site had resulted in some sheet or rill accelerated erosion of the surface horizon. The area had a slope of 0-2%.

The lower-lying adjacent soils in the floodplain were somewhat poorly drained, loamy textured with weak subsoil pedogenic development. The surfaces were dark grayish brown with gray subsoils in Munsell hues of 10YR. They were subject to seasonal flooding. The related upland soils of similar elevation on the Pleistocene surfaces were deep, mature soils with definitive yellow-red

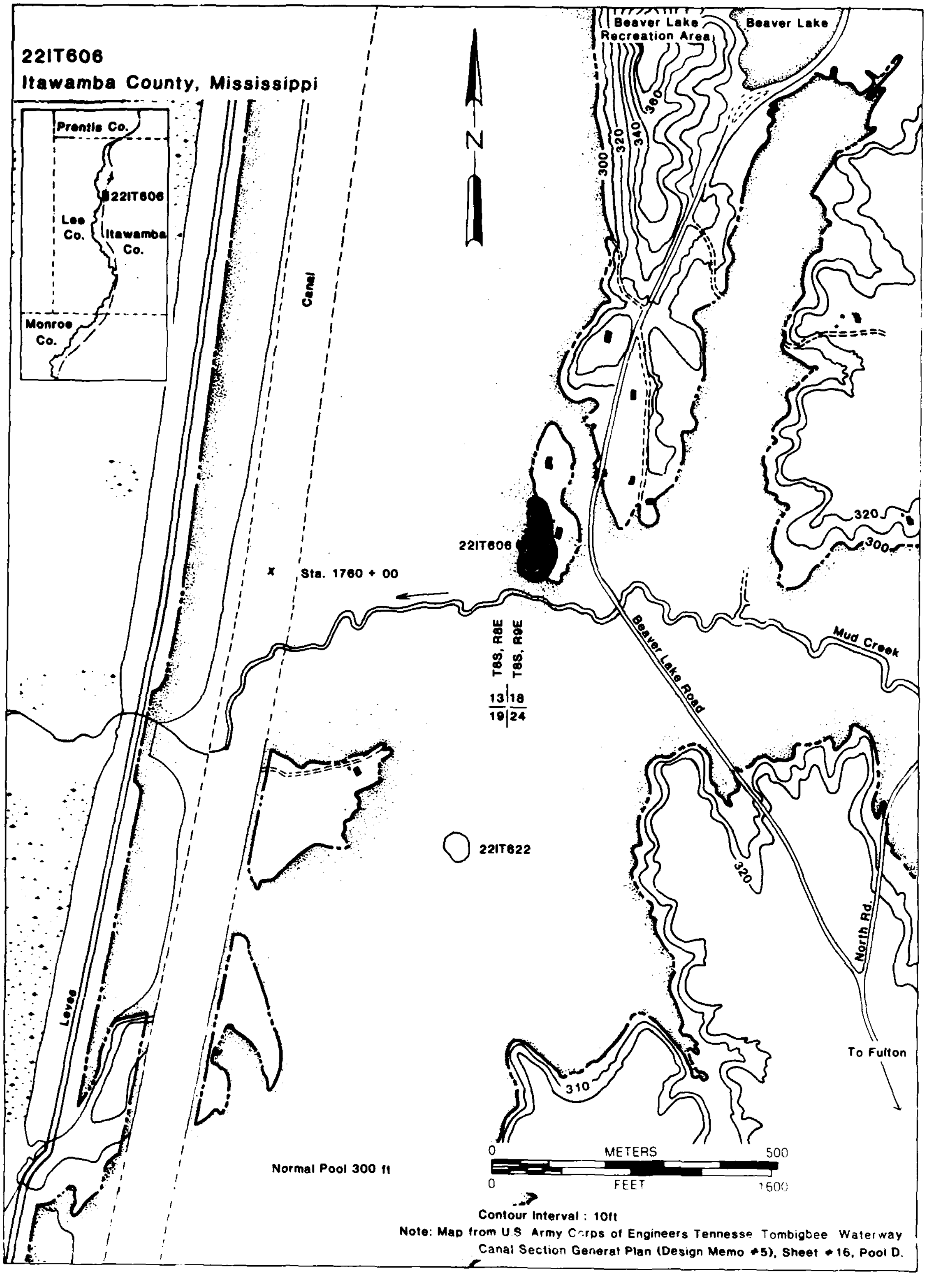


Figure 37 Site location of 22It606 and 22It622.

subsoil argillic horizons exhibiting strong pedogenic development. The upland soils were very strongly acid, highly weathered and siliceous with low base saturation (Ultisols). Some of the soils contained fragipan horizons at depths of 50-75 cm (19.7-29.5 in).

The floodplain soils adjacent to and below the site were dominantly within the Kirkville (coarse-loamy, siliceous, thermic Fluvaquentic Dystrochrepts) and Mantachie (fine-loamy, siliceous, acid thermic Aeric Fluvaquents) series. These soils had minimal pedogenic development with loamy textures exhibiting stratification. They had cambic (Bw) horizons with little eluviation and illuviation. They were subject to flooding during the winter and spring months.

The soil at the site had developed in Coastal Plain sediments and was very representative of mature soils of the area containing an argillic horizon. The upper part of the sola had been culturally altered imparting a darker color than occurs in such soils in nature. Recent cultivation had resulted in mixing the upper horizons. Cultural disturbance was limited to horizons located above the argillic horizon. The site soil had a well-developed paleosol at greater depths.

PHYSICAL DESCRIPTION

A representative pedon at the edge of the site, with cultural material in the upper 27 cm (10.6 in), had well-developed pedogenic characteristics (Table 77). The upper 27 cm (10.6 in) had darker colors in Munsell hues of 7.5YR which differed from undisturbed soils that had thinner surface horizons with 10YR hues. The natural soils also had thin, lighter colored E horizons in areas that had not been plowed or culturally disturbed. A well-developed argillic (Bt) subsoil horizon occurred at the site with most of the artifacts and evidence of cultural disturbance located above and in the upper part of the horizon. This indicates landscape stability, and pedogenic development had resulted in the formation of the mature soil prior to habitation of the site. Subsequent habitation and cultural disturbance affected the horizons above the argillic horizon, while the lower argillic from 27 cm (27.6 in) and deeper was not appreciably affected, and horizonation was readily discernible. The argillic horizon had subangular blocky structure with oriented clay skins on ped faces.

TABLE 77
Pedon description of representative pedon, 22It606.

Horizon	Depth (cm)	Description (moist colors)
Ap	0-10	Dark brown (7.5YR4/2) sandy loam; weak fine granular structure; very friable; common cultural fragments; common fine and medium roots; few charcoal flakes; gradual wavy boundary.
Bt1	10-27	Strong brown (7.5YR5/6) sandy loam; weak fine subangular blocky structure; friable; patchy clay skins on ped faces; few charcoal flakes and cultural fragments; common fine and medium roots; gradual wavy boundary.

TABLE 77

Pedon description of representative pedon, 22It606 (continued).

Horizon	Depth (cm)	Description (moist colors)
Bt2	27-79	Yellowish red (5YR4/6) loam; moderate fine subangular blocky structure; slightly firm in place, friable when disturbed; clay skins on ped faces; gradual wavy boundary.
Bt3	79-92	Strong brown (7.5YR5/6) sandy loam; moderate fine subangular blocky structure; slightly firm in place, friable when disturbed; clay skins on ped faces; gradual wavy boundary.
Bt4	92-115	Mottled reddish yellow (7.5YR6/6) and yellowish red (5YR4/8 and 5YR5/8) sandy loam; firm in place, friable when disturbed; patchy clay skins on ped faces; gradual wavy boundary.
2Btb1	115-140	Yellowish red (5YR5/6) sandy clay loam with common medium distinct reddish yellow (7.5YR6/6), red (5YR4/8) and pale brown (10YR6/3) mottles; moderate coarse prismatic parting to moderate medium subangular blocky structure; firm; gradual wavy boundary.
2Btb2	140-180	Yellowish red (5YR4/8) sandy clay loam with many medium distinct red, reddish yellow, strong brown and pale brown mottles; moderate coarse prismatic parting to moderate medium subangular blocky structure; firm; continuous clay coatings on ped faces; leached seams between prisms form a polygonal network; gradual wavy boundary.
2Btb3	180-250	Yellowish red (7.5YR5/8) sandy loam with common strong brown (7.5YR5/8) and pale brown (10YR6/3) mottles; moderate medium subangular blocky structure; firm; continuous clay coatings on ped faces; abrupt smooth boundary.
3C	250+	Strong brown (7.5YR5/6) loamy sand; loose; single grained.

A well-developed paleosol occurred at a depth of 100-150 cm (39.4-59.1 in) with a paleoargillic horizon of sandy clay loam textures. The paleoargillic horizon had medium-coarse prismatic structure which parted to moderate medium subangular blocky structure. The prisms were separated by lighter colored seams of fine sand and silt which formed a polygonal network. The paleoargillic horizon rested upon loamy sand.

Particle size distributions (Tables 78 and 79) indicate slight variations across the site with rather uniform textural classes of sandy loam and loam. Maximum clay contents occurred in the paleoargillic horizon at depths of 140-180 cm (55.2-70.9 in). The paleosol graded abruptly to loamy sand at depths of 250 cm (98.5 in). The sand fraction was dominated by fine and medium sand with lesser amounts of very fine sand. The very fine sand contents were higher in the paleoargillic horizon. There was an abrupt increase in the medium sand fraction in the underlying C horizon.

TABLE 78

Particle size distribution of representative pedon, Test Unit 106/94 22It606.

Depth	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Texture
cm	percentage			
0-7	57.7	39.1	3.2	sandy loam
7-18	57.3	39.6	3.1	sandy loam
18-47	38.5	48.5	13.0	loam
47-76	25.8	55.7	18.5	silt loam
76-100	39.1	44.8	16.1	loam
100-125	57.6	18.0	24.4	sandy clay loam

		Sand Fraction			
Depth	Very Coarse (2-1 mm)	Coarse (1-0.5 mm	Medium (0.5-0.25 mm)	Fine (0.25-0.10 mm)	Very Fine (0.10-0.05 mm)
cm	percentage				
0-7	1.0	1.1	9.3	35.7	10.5
7-18	0.3	0.9	11.3	34.1	9.7
18-47	0.1	0.5	5.7	23.6	8.6
47-76	0.4	0.6	3.8	15.0	6.1
76-100	0.3	0.6	7.5	23.1	7.5
100-125	0.0	0.0	5.1	40.0	12.5

TABLE 79

Particle size distribution of representative pedon, 22It606.

Depth	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Texture
cm	percentage			
0-10	59.0	38.2	2.8	sandy loam
10-27	58.6	33.6	7.8	sandy loam
27-79	46.3	38.4	15.3	loam
79-92	62.8	22.0	15.2	sandy loam
92-115	65.5	15.8	18.7	sandy loam
115-140	60.3	19.2	20.5	sandy clay loam
140-180	56.4	17.4	26.2	sandy clay loam
180-250	71.5	10.6	17.9	sandy loam
250+	87.1	4.7	8.2	loamy sand

		Sand Fraction			
Depth	Very Coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.10 mm)	Very Fine (.10-.05 mm)
cm	percentage				
0-10	2.3	0.6	.7.2	32.4	6.5
10-27	0.2	0.2	8.7	43.0	6.5
27-79	0.1	0.3	11.0	28.7	6.3
79-92	0.1	0.2	33.3	25.8	3.4
92-115	0.0	0.3	10.0	45.9	9.6
115-140	0.0	0.4	6.0	41.9	12.3
140-180	0.0	0.0	4.4	39.2	12.8
180-250	0.0	0.0	8.6	52.1	10.7
250+	0.0	0.3	42.4	41.5	2.9

The thickness of the paleoargillic horizon and the well-developed structure and oriented clay skins on ped faces suggest the paleosol formed over a long period of landscape stability. The prismatic structure and polygonal network appear to be relic pedogenic features.

CHEMICAL DESCRIPTION

Calcium and hydrogen were the dominant exchangeable cations (Tables 80 and 81). Calcium levels were greatest in the surface and reflect liming or cultural additions. Exchangeable Mg contents increased with depth and reached maximum levels in the paleosol. The Ca/Mg ratios also decreased with depth and were less than one in the paleoargillic horizon which reflects the greater weathering and age. Potassium levels were higher in the upper layers. Trace levels of Na were detected. Exchangeable Al increased with depth and reached maximum levels in the paleoargillic horizon which also indicates greater weathering and age in the paleosol. Maximum cation exchange capacity values (Total, Tables 80 and 81) occurred in the paleoargillic horizon and coincided with maximum clay content. Base saturation levels were higher in the surface layers and reflect cultural additions of $CaCO_3$.

TABLE 80
Chemical characteristics of representative pedon, Test Unit 106/94, 22It606.

Depth	pH	Organic Matter	Exchangeable Cations Ca	Mg	K	Na	H	Al	Total	Base Saturation
cm		---%---	Cmol (p+) kg-1							
0-7	5.2	2.23	1.80	0.67	0.49	0.04	7.90	0.54	10.90	27.5
7-18	5.2	1.24	1.61	0.59	0.29	0.02	6.07	0.48	8.58	29.2
28-47	4.8	0.47	0.92	0.75	0.37	0.10	7.08	1.92	9.22	23.2
47-76	4.6	0.23	1.09	0.74	0.50	0.03	9.35	3.97	11.71	20.1
76-100	4.4	0.11	0.94	0.97	0.18	0.04	7.63	3.52	9.76	21.8
100-125	5.2	0.10	0.47	1.14	0.09	0.14	10.82	6.55	12.66	14.5

TABLE 81
Chemical characteristics of representative pedon, 22It606.

Depth	pH	Organic Matter	Exchangeable Bases Ca	Mg	K	Na	H	Al	Total	Base Saturation
cm		%	Cmol (p+) kg-1							%
0-10	5.2	3.48	3.59	0.68	0.37	0.01	6.84	0.12	11.49	40.4
10-27	5.1	0.76	1.13	0.49	0.28	0.02	3.65	0.60	5.57	34.4
27-79	5.0	0.32	1.30	0.79	0.20	0.04	5.71	1.93	8.04	28.9
79-92	4.8	0.09	0.69	0.86	0.14	0.04	6.25	2.66	7.98	21.6
92-115	5.0	0.09	0.57	1.09	0.21	0.05	7.68	4.18	9.60	20.0
115-140	5.1	0.11	0.33	0.69	0.11	0.10	7.71	4.16	8.94	13.8
140-180	5.0	0.10	0.44	1.04	0.10	0.14	10.33	6.05	12.05	14.3
180-250	4.8	0.08	0.39	0.73	0.05	0.07	7.59	4.76	8.83	14.0
250+	4.8	0.08	0.22	0.39	0.07	0.04	4.38	2.60	5.10	14.1

Soil pH levels varied with depth and tended to decrease at the lower depths. Levels did not differ greatly from natural soils that had not been disturbed. Organic matter contents were highest in the surface horizons and decreased with depth. Levels varied somewhat across the site.

Total nitrogen decreased with depth and generally was related to the organic matter contents (Table 82). The C/N ratios were similar to levels of natural soils of the area.

TABLE 82
Organic carbon, nitrogen, carbon/nitrogen ratio, and 1% citric acid soluble P205 contents of representative pedon, 22It606.

Depth	C	N	C/N	1% Citric Acid Soluble P205
(cm)	---------percentage---------			ppm
0-10	2.01	0.182	11.0/1	343.1
10-27	0.44	0.043	10.2/1	0
27-79	0.18	0.031	5.8/1	0
79-92	0.05	0.026	1.9/1	0
92-115	0.05	0.026	1.9/1	0

The surface layer contained more than 250 ppm P_2O_5 (soluble in 1% citric acid), but none was detected at lower depths (Table 83). The P_2O_5 levels of the surface horizon are related to occupation and cultural additions.

MINERALOGICAL DESCRIPTION

Kaolinite was the dominant clay mineral with lesser amounts of illite, vermiculite-chlorite integrade, and quartz in the upper sola from depths of 0-115 cm (0-45.3 in). However, a change was detected in the clay mineral suite in the paleosol by X-ray diffraction and differential thermal analyses which indicated the presence of smectite and gibbsite in the paleoargillic horizon. The mineral suite in the paleosol between the depths of 115-250 cm (45.3-98.5 in) consisted of kaolinite with lesser amounts of illite, smectite, gibbsite, and quartz. Gibbsite contents reached a maximum at depths of 140-180 cm (55.2-70.9 in) and comprised 10-15% of the clay minerals at that depth.

SUMMARY

Site 22It606 was located in an upland position on a Pleistocene terrace near the confluence of the Tombigbee River and Mud Creek. The site was above the floodplain and it was not subject to flooding. The site soil was altered in the surface horizons by occupation and cultural additions which imparted a darker color with Munsell hues of 7.5YR. The subjacent argillic horizon was relatively unaffected by cultural changes, and it had strong brown (7.5YR hue) and yellowish red (5YR hue) colors. Soil morphology indicated eluviation and pedogenic development of the argillic horizon, and sola were completed prior to human occupation and disturbance.

A well-developed paleosol with a thick paleoargillic horizon occurred at depths below 115 cm (45.3 in). The paleosol was yellowish red with a 5YR hue and had compound structure of prismatic parting to subangular blocky. The prismatic structural units were separated by lighter colored, leached seams of silt and sand which formed a polygonal network. The polygonal macro-structure appeared to be a relic pedological feature. Particle size distribution was rather uniform over the site with maximum clay contents occurring in the paleoargillic horizon. An abrupt increase in the medium sand fraction occurred in the underlying C horizon at depths below 250 cm (98.5 in).

Calcium and hydrogen (acidity) were the dominant exchangeable cations of the site soil. Higher Ca levels in the surface horizon reflected agricultural additions of lime and/or other cultural additions. The Ca/Mg ratios decreased with depth reflecting greater weathering and age. Exchangeable aluminum increased with depth and reached maximum levels in the paleoargillic horizon an indication of weathering and age. Soil pH levels varied with depth but did not differ greatly from non-site adjacent soils.

Total nitrogen decreased with depth and was related to organic matter contents. The C/N ratios were similar to natural soils of the area. The surface layer contained more than 250 ppm P_2O_5 (soluble in 1% citric acid), and none was detected at lower depths, indicating the cultural additions were primarily in the surface. The paleosol had a different mineral suite characterized by the presence of smectite and gibbsite in the clay fraction which was not detected in the upper sola.

THE MUD CREEK SITE (22It622)

The Mud Creek site is a small rise in the floodplain approximately 500 m (1,650 ft) south of 22It606 at the junction of the Mud Creek and The Tombigbee River floodplains (Figure 35). Mud Creek flows north of the site approximately 400 m (1,320 ft). The site rises over a meter above the general elevation of the surrounding floodplain and is roughly circular in outline plan. The flanks have a 1-2% angle of slope.

The lower-lying adjacent soils in the floodplain were somewhat poorly drained, loamy textured with weak subsoil pedogenic development. The surfaces were dark grayish brown with gray subsoils in Munsell hues of 10YR. They were subject to seasonal flooding. The related upland soils of similar elevation on the Pleistocene surfaces were deep, mature soils with definitive yellow-red subsoil argillic horizons exhibiting strong pedogenic development. The upland soils were very strongly acid, highly weathered, and siliceous with low base saturation (Ultisols). Some of the soils contained fragipan horizons at depths of 50-75 cm (19.7-29.6 in).

The floodplain soils adjacent to and below the site were dominantly within the Kirkville (coarse-loamy, siliceous, thermic Fluvaquentic Dystrochrepts) and Mantachie (fine-loamy, siliceous, acid thermic Aeric Fluvaquents) series. These soils had minimal pedogenic development with loamy textures exhibiting stratification. They had cambic (Bw) horizons with little eluviation and illuviation. They were subject to flooding during the winter and spring months.

The culturally altered site soils are developed in alluvial loam to sandy loam deposits. These soils are readily distinguished by the thick, dark, reddish brown, humus-stained epipedons from human occupation. Soils in the upper 50 cm (19.7 in) were distinctively different from adjacent undisturbed floodplain soils which had thin surface horizons. The sediments had also been severely disturbed by bioturbation. Most stratigraphic boundaries are gradual and wavy. Six identifiable strata were recognized. All of these strata were above the dry-season water table.

PHYSICAL DESCRIPTION

Particle size distributions (Table 83) indicate textural stratification. Sandy loam textures occurred throughout the representative pedon, except for the 50-108 cm (19.7-42.6 in) depth, which had a loam texture containing the highest clay (14.8) and silt (46.3) contents and the lowest sand (38.9%)

content. The sand fraction was dominated by fine (0.25-0.10 mm) and medium (0.5-0.25 mm) sand, with lesser amounts of very fine sand, and trace amounts of coarse and very coarse sand.

TABLE 83
Particle size distribution of representative pedon, 22It622.

Depth	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Texture
cm	percentage			
0-15	71.1	25.9	3.0	sandy loam
15-29	65.9	26.2	7.9	sandy loam
29-50	53.1	36.8	10.1	sandy loam
50-108	38.9	46.3	14.8	loam
108-122	72.5	22.5	5.0	sandy loam

Depth	Sand Fraction Very Coarse (2-1 mm)	Coarse (1-.5 mm)	Medium (.5-.25 mm)	Fine (.25-.10 mm)	Very Fine (.10-.05 mm)
cm	percentage				
0-15	0.30	0.80	25.90	38.40	5.80
15-29	0.10	0.20	25.00	36.20	4.50
29-50	0.03	0.10	16.00	32.60	4.30
50-108	0.03	0.10	12.70	22.70	3.60
108-122	0.03	0.40	29.40	38.50	4.20

CHEMICAL DESCRIPTION

Soil pH levels decreased with depth (Table 84) and ranged from 5.9 in the surface layer to 4.6 in the 108-122 cm (42.6-48.1 in) depth. Only the surface layer (0-15 cm or 0-5.9 in) had pH levels higher than adjacent off-site soils. Calcium and hydrogen (acidity) were the dominant exchangeable cations. Calcium levels decreased abruptly with increasing depth with the surface horizon containing levels several hundred fold greater than the subjacent layers, which suggests liming and/or cultural additions. Soil magnesium contents also decreased with depth. Ca/Mg ratios varied with depth and ranged from 8.39 in the surface to 1.5 at depths of 108-122 cm (42.6-48.1 in). Potassium levels were slightly higher in the 29-50 cm (11.4-19.7 in) layer and decreased abruptly at a depth of 108 cm (45.6 in). Trace levels of sodium were present. Exchangeable aluminum had maximum values in the 50-108 cm (19.7-45.6 in) layer which corresponded to the higher clay content. The cation exchange capacity values were low indicating a dominance of kaolinite and 1:1 phyllosilicate minerals.

TABLE 84
Chemical characteristics of representative pedon, 22It622.

Depth	pH	Exchangeable Cations Ca	Mg	K	Na	H	Al	Total	Base Saturation
cm		Cmol (p+) kg-1							percentage
0-15	5.9	3.61	0.43	0.16	0.02	4.82	0.01	9.04	14.68
15-29	4.6	0.89	0.24	0.13	0.02	5.92	1.18	7.20	17.78

TABLE 84
Chemical characteristics of representative pedon, 22It622 (continued).

		Exchangeable Cations							Base
Depth	pH	Ca	Mg	K	Na	H	Al	Total	Saturation
cm		----------		Cmol	(p+)	kg-1		----------	percentage
29-50	4.5	0.64	0.10	0.22	0.03	6.23	1.87	7.22	13.71
50-108	4.6	0.90	0.25	0.17	0.03	7.58	3.73	8.93	15.12
108-122	4.6	0.24	0.16	0.06	0.05	3.22	1.48	3.73	13.67

Organic matter content exceeded 1.3% in the surface horizon and decreased abruptly with increasing depths to levels less than 0.3% in subjacent layers (Table 85). Total nitrogen levels also decreased with depth, decreasing from 0.081% in the surface layer to 0.012% at a depth of 108 cm (45.6 in). The C/N ratio decreased with depth to very low values in the deeper strata where only trace levels of C and N were detected.

TABLE 85
Organic matter, carbon, nitrogen contents, carbon/nitrogen ratio, and 1% citric acid soluble P205 contents of representative pedon, 22It622.

Depth	Organic Matter	C	N	C/N	1% Citric Acid Soluble P205
cm	---------	percentage	---------		ppm
0-15	1.33	0.77	0.081	9.5/1	121.20
15-29	0.35	0.20	0.028	7.1/1	121.30
29-50	0.32	0.18	0.029	6.2/1	40.01
50-108	0.16	0.09	0.019	4.7/1	4.07
108-122	0.03	0.01	0.012	0.8/1	0.00

Citric acid extractable P_20_5 levels were much less than the minimum level of 250 ppm highest P_20_5 contents which were slightly higher than levels of adjacent off-site soils (40 ppm).

THE BEECH AND OAK SITES (22It623 and 22It624)

The Beech and Oak sites are situated on adjacent levee remnants in the floodplain of the Tombigbee River Valley. The two sites are two fragments of the same geomorphological and archaeological entity. Located some 8 km (5 mi) north of Fulton, Ms, the sites are approximately 1.8 km (1 mi) east of the main river channel and 250 m (820 ft) west of the eastern valley escarpment.

The lower-lying adjacent soils in the floodplain were somewhat poorly drained, loamy textured with weak subsoil pedogenic development. The surfaces were dark grayish brown with gray subsoils in Munsell hues of 10YR. They were subject to seasonal flooding. The related upland soils of similar elevation on the Pleistocene surfaces were deep, mature soils with definitive yellow-red subsoil argillic horizons exhibiting strong pedogenic development. The upland soils were very strongly acid, highly weathered and siliceous with low base saturation (Ultisols). Some of the soils contained fragipan horizons at depths of 50-75 cm (19.7-29.6 in).

The floodplain soils adjacent to and below the site were dominantly within the Kirkville (coarse-loamy, siliceous, thermic Fluvaquentic Dystrochrepts) and Mantachie (fine-loamy, siliceous, acid thermic Aeric Fluvaquents) series. These soils had minimal pedogenic development with loamy textures exhibiting stratification. They had cambic (Bw) horizons with little eluviation and illuviation. They were subject to flooding during the winter and spring months.

The site landform was formed by overbank deposition from the east which has resulted in deposits being thicker and coarser on the east as well as the northern end of this levee remnant.

The Beech and Oak sites are composed of three major stratigraphic zones. An upper, thick dark midden zone just under the forest humus contains mostly mixed remains of many components. It overlies pale sands which are not visibly culturally altered, but which do contain artifact materials as well as features originating from above. Six strata were identified at the sites and are described in Table 86.

TABLE 86

Description of representative profile, 22It623 and 22It624.

Depth/ Strata	Description
0-10/I	Dark reddish brown (5YR5/2) forest humus or topsoil averaged about 10 cm thick.
10-50/ IIA	This zone was divided into two substrata based primarily on color and root content at both sites. Stratum IIA, a dark reddish brown (5YR3/2) to dark brown (7.5YR3/4) sandy loam, averaged 35-40 cm thick. It had very weak, subangular, blocky, friable soil with many rootlets and approximately 2-3% charcoal flecks.
45-80/ IIB	Slightly lighter color - dark reddish brown (5YR3/4) to very dark brown (10YR3/2) - sandy loam averaging about 35 cm thick; very weak, subangular blocky, friable soil with few rootlets and less than 2% charcoal flecks.
80-100/ III	Transitional zone with reddish brown (5YR4/3) to brown (7.5YR4/4) loamy sand with a small amount of light yellow (10YR6/4) and light gray (10YR7/1) mottling due most likely to natural disturbances.
110-120/ IV	Relatively unaltered fluvial sand stratum quite variable in thickness and appearance; generally, it was composed of yellowish brown (10YR5/8) to very pale brown (10YR7/4) loamy sand with some lighter yellowish or grayish (10YR7/1, 8/4) mottling due to bioturbation. It ranged from about 10-50 cm and banded in the middle with a partially developed illuvial zone 5-20 cm thick of dark yellowish brown (10YR4/4) to strong brown (7.5YR4/6) sandy loam. This band was identified substratum IVB, and the paler sands above and below it IVA and IVC, respectively.
120-140/ V	A well-developed illuvial deposit formed by the heavy concentration of fine iron-rich sediments in an exceptionally clearly defined layer directly atop the impermeable paleosol, marking the level of the water table. This stratum is composed of firm dark yellowish brown (10YR4/4) to strong brown (7.5YR4/6) sandy loam with a higher colloid content because of the perched water table. It contained a high amount of manganese and ferruginous sandstone nodules concentrating above the impervious paleosol.

TABLE 86
Description of representative profile, 22It623 and 22It624 (continued).

Depth/ Strata	Description
140+/ IV	This buried soil horizon is made up of a yellowish brown (10YR5/8) sandy loam matrix heavily mottled and streaked with yellow (10YR7/6, 2.5YR7/4), brown (7.5YR5/8), light gray (5Y7/1) sandy loam and clayey sand. Subangular, blocky structure with clay skins on the ped faces.

PHYSICAL DESCRIPTION

The particle size distribution (Table 87) reflects prominent textural stratification due to episodal fluvial sedimentation. Sandy loam and loamy sand textures occurred in the representative pedon analyzed. The loamy sand layers at depths of 47-122 cm (18.5-48.1 in) reflect higher energy fluvial events. Highest sand contents occurred in the loamy sand layers. Silt contents were greatest in the surface layers, while clay contents were greatest at depths of 122-162 cm (48.1-63.8 in). Fine and medium sand classes dominated the sand fraction with lesser amounts of very fine sand (0.10-0.05 mm) and traces of coarse and very coarse sand.

TABLE 87
Particle size distribution of representative pedon, 22It623.

Depth	Sand (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (< 0.002 mm)	Texture
cm	percentage			
0-28	66.2	28.9	4.9	sandy loam
28-47	65.7	26.6	7.7	sandy loam
47-84	79.4	17.6	3.0	loamy sand
84-122	84.5	12.7	2.8	loamy sand
122-135	72.9	14.3	12.8	sandy loam
135-162	63.4	23.2	13.4	sandy loam

			Sand Fraction		
Depth	Very Coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.05 mm)	Fine (0.25-0.10 mm)	Very Fine (10-0.05 mm)
cm	percentage				
0-28	0.80	1.00	28.20	31.00	5.20
28-47	0.04	0.20	5.60	51.10	8.80
47-84	0.03	0.10	29.50	43.50	6.30
84-122	0.00	0.03	6.90	69.50	8.10
122-135	0.00	0.03	6.30	58.60	8.00
135-162	0.10	0.10	6.60	45.20	11.40

The upper 110-120 cm (43.3-47.3 in) of the profile was dark brown organically stained with weak subangular blocky structure. A transition zone Stratum IVB is thought to have developed because of the concentration of iron-rich sediments at the level of a perched water table which must have been in existence for some time. It is a weaker, paler version of Stratum V. Its transformation into a different substratum most probably took place after cultural occupation and fluvial deposition had covered it. Stratum VI was a paleosol exhibiting subangular blocky structure with clay skins on the ped faces. It is highly weathered and has been eroded with the A and part of the B horizons removed. Polygonal cracks are also present. This strata has the highest clay content on the site.

CHEMICAL DESCRIPTION

Soil pH levels (Table 88) were extremely acid with levels increasing slightly with depth. Soil pH levels were similar to those of adjacent off-site soils. Hydrogen and aluminum were the dominant exchangeable cations. Hydrogen values decreased with depth, while exchangeable aluminum levels varied considerably. Exchangeable calcium increased with depth reaching maximum levels at depths of 122-162 cm (48.1-63.8 in). The increased Ca levels were accompanied by proportional increases in percent base saturation. Exchangeable Mg and K also tended to increase with depth. Trace levels of Na were detected. The Ca/Mg ratio also tended to increase with increasing depths. Very low cation exchange capacity values (Total, Table 89) occurred in the loamy sand layers. Base saturation values were highest at the greater depths.

TABLE 88
Chemical characteristics of representative pedon, 22It623.

		Exchangeable Cations							Base
Depth	pH	Ca	Mg	K	Na	H	Al	Total	Saturation
cm		————		Cmol	(p+)	kg-1	————		percentage
0-28	4.5	0.07	0.03	0.05	0.02	14.5	2.9	14.70	1.16
28-47	4.5	0.08	0.06	0.05	0.02	10.7	3.0	10.91	1.19
47-84	4.6	0.05	0.02	0.03	0.01	5.0	2.1	5.16	2.13
84-122	4.8	0.27	0.18	0.03	0.01	2.3	1.5	2.80	17.50
122-135	4.9	1.90	0.43	0.10	0.04	6.8	3.6	9.29	26.59
135-162	4.8	1.87	0.35	0.10	0.04	8.7	5.2	11.09	21.28

Organic matter contents were highest in the 0-28 cm layer (0-11 in) (Table 89). Abrupt decreases in the organic matter contents occurred at depths below 47 cm (18.5 in), suggesting less cultural additions from habitation. Nitrogen contents decreased abruptly with depth with the C/N ratio following a similar trend.

TABLE 89
Organic matter, carbon, nitrogen contents, carbon/nitrogen ratio, and 1% citric acid soluble P205 contents of representative pedon, 22It623.

Depth	Organic Matter	C	N	C/N	1% Citric Acid Soluble P205
cm	———	percentage	———		ppm
0-28	1.80	1.04	0.117	8.8/1	0.0
28-47	0.59	0.34	0.045	7.5/1	141.6
47-84	0.25	0.14	0.012	11.6/1	120.7
84-122	0.03	0.01	0.005	2.0/1	0.0
122-135	0.09	0.05	0.016	3.0/1	40.5
135-162	0.09	0.05	0.018	2.7/1	60.8

Citric acid soluble P_2O_5 contents were very erratic. No P_2O_5 (extractable in 1% citric acid) was detected in the 0-28 cm (0-11 in) and 84-122 cm (33.1-48.1 in) layers. Maximum levels occurred in the 28-84 cm (11-33.1 in) layers, but values were far below the 250 ppm required for anthropic epipedons (Soil Taxonomy 1965). The lower levels of P_2O_5 may be associated with less cultural additions. These layers also have very low clay contents which could retain the P_2O_5 against leaching.

PEDOGENIC INFERENCES

Prolonged cultural disturbance of natural soils alters normal pedogenic development and may impart definitive characteristics which persist over time. The pedoturbation by man effects the soil body in a unique, singular manner, or produces a composite synergistic result. These resultant features tend to be masked by progressive weathering and forces of nature, including subsequent pedogenic development, erosion and deposition of soil materials, and intense biological activity from plants and organisms.

Soil profiles reflect the different stages of horizon development that correspond to the different time lengths during which the soil materials have been exposed to soil forming processes (Thorp 1965). Wider variations may be expected in the characteristics of more recent soils than in older, mature soils (Harradine 1949). Human cultural alteration and natural fluviatile actions can destroy previous soil development and result in relatively juvenile soils over a wide chronological period. Superimposed soil profiles in fluviatile deposits may be formed on discrete deposits due not only to climatic variation, but also to aggrading, swinging streams depositing sediment loads in various places, with superposition spaced widely enough to allow soil formation (Stephens 1965). These fluviatile pedons may have differences in texture and mineralogy associated with their original position on levee banks of the floodplain.

SOIL DEVELOPMENT IN ARCHAEOLOGICAL SITES

Several studies have addressed soil development in archaeological sites to relate the degree of pedogenic development with elapsed time. McComb and Loomis (1944) studied Indian mounds in forested regions of the DesMoines River in Boone County, Iowa, and reported a lack of eluviation or accumulation of clay to form B horizons within a 1,000 year time period. They concluded at least 1,000-2,000 years were required to produce detectable soil changes under forest in Iowa. Parson et al. (1962) compared soil development of seven prehistoric Indian mounds in northeastern Iowa. They reported mound soils reached their present horizonation in a period of no more than 2,500 years. They concluded that A1 horizons which formed under deciduous forest vegetation in northeastern Iowa attained a maximum degree of expression within 1,000 years or less and remained relatively constant in composition with increasing age. They also concluded clay translocation may be evident between 1,000 and 2,500 years of age.

Holliday (1985) recently studied soil development in sites located in late Holocene deposits at Lubbock Lake in the Southern High Plains of Texas in a restricted rainfall area. Soil ages ranged from 5,000-200 years before present. He reported the presence of argillic and cambic horizons in the Lubbock Lake soil (4,500-5,000 B.P.). Holliday concluded cambic horizons formed in sediments of 450-800 years.

The influence of human activities such as fires, waste disposal and burials on the soil chemical characteristics has been documented (Hoidenreich et al. 1971; Lutz 1951; Griffith 1980). Primary emphasis has been directed to elevated phosphorus levels attributed to prolonged human activity, with less attention given to other chemical attributes. Recently, Griffith (1980) reported that magnesium, organic phosphorus, and inorganic phosphorus relative levels were sufficiently different to be useful in distinguishing formerly occupied soils from off-site soils. Galm (1978) reported that neutral pH levels, clay content, and high iron oxide contents in soils of the Curtis Lake site in Oklahoma were useful indices of human cultural activity.

The morphological expressions of buried soils which have remained unmodified reveal something of the conditions prevailing during a discrete period in contrast to soils exposed on residual features which reflect cumulative effects. Buried soils represent the product of soil-forming processes over a time interval between cessation of deposition and its recommencement.

GEOMORPHIC SETTING AND SOIL PARENT MATERIAL

Sites 22It539, 22It576, 22It590, 22It622, and 22It623/22It624 occupied topographic highs of the Tombigbee River floodplain, rising 1-3 m (3.3-9.9 ft) above it. Site 22It606 was located on a Pleistocene terrace which had been incised by the Tombigbee River and Mud Creek, and it was not subject to flooding. The Tombigbee River is an underfit stream which has meandered from the eastern to the western part of the floodplain. It is currently an aggrading stream. The river has the common fluvial features including ox-bows, natural levees, and point bars. The river fills the floodplain channel only during flood stages which usually occur in the winter and spring months. The off-site floodplain soils are saturated much of the year, and they exhibited little pedogenic development with bedding planes persisting. The soils had reduced conditions which were reflected by gleyed colors in the subsoils.

The Tombigbee Hills of the study areas were comprised of unconsolidated marine sediments of Upper Cretaceous age. The Eutaw and Tuscaloosa formations outcropped in the area and provided the parent material for the upland soils and alluvial deposits (Stepheson and Monroe 1940). The Tuscaloosa formation is characterized by irregularly bedded sand, clay, and gravel. The Eutaw formation is generally comprised of cross-bedded glauconitic sand and clay. The Tombigbee Hills have apparently been eroding and redepositing in the Tombigbee River floodplain since Pleistocene and perhaps late Pliocene time (Stepheson and Monroe 1940). Current Holocene sediments in the active floodplain are heterogeneous and related to current erosion and deposition processes. The floodplain had a dense cover of deciduous vegetation. Precipitation in the study area ranged from 125-140 cm (49.3-55.2 in) with a frost-free period of 200-240 days (Pettry 1977).

The Entisols and Inceptisols comprising the floodplain exhibited little profile development and horizonation. Typically, these soils had thin surface horizons underlain by stratified materials or cambic horizons with little evidence of translocated clay. The deeper horizons had gleyed colors which reflected the saturated, reduced conditions. The water table in these soils ranged from at or above the surface during winter and spring to depths of 2 m (6.6 ft) or greater in the summer and early fall seasons. Periodic overflow resulted in surface scouring in the high energy floodwater areas and deposition in slack water areas.

Sedimentation rates calculated from the sediment thickness and ages of major cultural component segments of 22It576, 22It539, and 22It590 indicate a progressive decline in sedimentation rates from the early Holocene (Kirk: 9,500-10,000 B.P.) to the present (post-Benton, 5,000 B.P. - present) as shown in Table 90. Pre-5,000 B.P. sedimentation rates ranged from 8 cm (3.2 ft)/century at 22It590 to 17.6 cm (6.9 in)/century at 22It576 which was located about 16 km (9.9 mi) downstream at an elevation 6-7 m (2.4-2.8 in) lower. Both sedimentation rates and sediment thickness increased with increasing distance from the headwaters. Site 22It590 was located near the headwaters of Mackey's Creek with a smaller watershed than 22It539 and 22It576. Post-5,000 B.P. sedimentation rates averaged less than 2 cm(.8 in)/century for all the sites. Calculated annual sedimentation rates may not be an accurate depiction of yearly accumulation events, but the data clearly reflect much greater sedimentation during the early Holocene period. Geomorphic stability was probably less during the early Holocene period and suggests lower artifact densities may be expected in these strata.

TABLE 90
Summary of sedimentation rates by cultural component and elevation.

	22It576		
Cultural Component	Elevation (m)	Sed. (cm)	cm/ century
Kirk	79.0-79.88	88	17.6
Eva/Morrow Mountain	80.2-80.4	20-40	3.3-1.5
Sykes/White Springs	**not definable**		
Benton	80.4-80.6	20	2-4
post-Benton	80.6-81.28	68	1.2

	22It539		
Cultural Component	Elevation (m)	Sed. (cm)	cm/ century
Kirk	86.5-87.25	75	15
Eva/Morrow Mountain	87.15/25-87.5	25-40	2.2-3.5
Sykes-White Springs	87.5/7-88.0	30-50	6-10
Benton	88.0/1-88.3	30-40	6-8
post-Benton	88.25-89.03	78	1.2-1.6

	22It590		
Cultural Component	Elevation (m)	Sed. (cm)	cm/ century
Kirk	96.1-96.5	40	8
Eva/Morrow Mountain	96.4.5-96.7/8	30	1.5-3.3
Sykes-White Springs	**not definable**		
Benton	96.7/8-96.9	10-20	2-4
post-Benton	96.9-97.3	40	0.7

Note: Calculated using best defined cultural zones and/or natural zones. Was conservative with data - used best-defined zones and components. Components best defined are Kirk, Benton, and post-Benton. Components least defined are Eva/Morrow Mountain (upper portion likely eroded away) and Sykes-White Springs (may be part of Benton at 22It539).

The incremental additions of fresh alluvium over time to the sites in the floodplain resulted in cumulative soil development. The A (surface) horizons of cumulative soils such as in sites investigated developed continual deposition of fresh sediments on the surface.

The soils on the Pleistocene uplands bounding the Tombigbee floodplain were typically acid, highly leached, well-developed Ultisols with low base saturation levels and organic matter contents. The mature upland soils had definitive argillic horizons of illuviated clays with Munsell colors that ranged from yellow-brown (10YR5/4) to red (2.5YR4/6). Firm, dense fragipan horizons occurred in some upland soils on broad, gentle slopes.

ANTHROPIC EPIPEDONS

Anthropic epipedons are diagnostic horizons that form at the soil surface. They are dark-colored horizons rich in organic matter which have resulted from long-continued use of the soil by man as a residence or site for irrigated crops. According to Soil Taxonomy (1975), requirements for anthropic epipedons include the following:

a. Soil structure is strong enough that the horizon is not both massive and hard, or very hard when dry.
b. Have Munsell color value darker than 3.5 when moist and 5.5 when dry and chroma less than 3.5 when moist; the color value is at least one Munsell unit darker or the chroma is at least two units less than the underlying 1C horizon.
c. Organic carbon content is at least 0.6 (1% organic matter).
d. The epipedon has more than 250 parts per million (ppm) of P_2O_5 soluble in 1% citric acid.

Sites 22It539, 22It576, and 22It590 had epipedons which met the criteria for anthropic with Munsell value and chroma colors darker than 3.5 accompanied by organic matter contents exceeding one percent and contained greater than 250 ppm P_2O_5 extractable in 1% citric acid. Site 22It539 had layers occurring at depths of 0-20 cm (0-7.9 in) and 50-80 cm (19.7-31.5 in) which met the anthropic criteria. Site 22It576 had layers from 0-80 cm (0-31.5 in) which met the criteria, while 22It590 had an anthropic epipedon extending from the surface to depths of 69 cm (27.2 in). Base saturation was about 40% in the anthropic epipedon of 22It539, and exceeded 50% in 22It576 except for the 0-10 cm (0-3.9 in) layer. Site 22It590 had base saturation levels near 50% except for the 0-30 cm (0-11.8 in) increment.

Sites 22It622, 22It623, and 22It606 did not have horizons which met the necessary anthropic requirements due to low P_2O_5 contents and/or colors which were too light.

The anthropic epipedons are distinctive features of the sites and serve as prominent indicators of the long-term habitation. The additions and incorporations of waste, plant materials, and other components over the duration of habitation synergistically produced the unique horizonation which differs markedly from natural, undisturbed soils. Soil organic components result from incorporation of the biomass of the site. Typically, the organic fraction may be divided into the part where plant parts can be recognized, and the completely decomposed materials. The organic fraction is generally composed of 1) carbohydrates, 2) amino acids and proteins, 3) lipids, 4) nucleic acids, 5) lignins, and 6) humus (Tan 1972). The organic fraction of the sites studied was dominantly well decomposed with very low content of recognizable plant parts. The soil polysaccharides have a profound influence on soil physical and chemical conditions and affect pedogenesis. Interaction of soil polysaccharides with soil particles promotes soil aggregation and the formation of granular structure (Greenland et al. 1961). The stabilizing effect on soil structure has been attributed primarily to cementation effects. The organic compounds interact with clay surfaces and compete with water molecules for adsorption sites and reduce wetting and swelling, thus enhancing cementation (Tan 1982). Well-developed granular soil structure and the tendency to repel water were prominent characteristics of the anthropic epipedons.

The highly decomposed or humified organic matter is referred to as humus, and it is considered to be the end product of decomposition of plant materials in soils. Previously, humus was classified into 1) humic acid, 2) fulvic acid, and 3) insoluble humin, the inert part. Currently, humic compounds are defined as amorphous, colloidal, polydispersed substances with yellow to brown-black color and high molecular weights (Tan 1982). Analyses of the anthropic epipedons indicated the humus was dominantly humic acid compounds with high molecular weights (Tan and Giddens 1972).

Soil humus content in the southern region of the United States seldom exceeds 3.5%, and it is concentrated in a relatively thin surface horizon. Very low contents typically occur with increasing depths. The carbon/nitrogen (C/N) ratio usually declines in the humification process from values in excess of 20 for fresh material to values of 8 to 20 for humus (Tan 1982). Fitzpatrick (1980) reported subsoil middle horizons may have C/N ratios as low as 4 that may be due to a high content of ammonium ions fixed by the clay. Carbon/nitrogen ratios tended to be erratic with increasing depths, increasing to 44/1 at depths of 50-60 cm (19.9-23.6 in) in 22It576, 40/1 at 110-120 cm (43.3-47.3 in) in 22It539 and 30.8/1 in 22It590. Despite the large C/N increases, no intact organic matter was detected in these strata. The erratic C/N levels with depth appear to be a diagnostic reflection of discrete cultural components. The higher subsurface C/N levels of 22It539, 22It576, and 22It590 generally coincided with the Benton components.

The extent of organic compound movement from one strata to another, or removal from the profile is a very complex issue which is greatly complicated by physical perturbation of the sites during and after occupation. However, in natural soils it is theorized that mobile organic materials are leached in acid environments and move downward to some depth were they are rendered immobile by chemical combination with aluminum and iron compounds (Holzhey et al. 1975). The humic/fulvic acid ratio reportedly increases with depth in such conditions (McKeague 1968). Holzhey and co-workers (1975) reported the thick, black organic accumulations in spodic horizons were generally absent when clay contents were above 10%. They postulated migrating organics accumulated and apparently polymerized to humic acids in sands until some maximum organic content was attained. They surmised that beyond that maximum little accumulation occurred, although migration continued. Organics moving with percolating waters were dominantly fulvic acids, whereas the water-insoluble organics were dominantly humic acids. Laboratory tests conducted on the epipedons of 22It539, 22It576, and 22IT590 indicated dominantly water-insoluble humic acid compounds.

The well-developed granular structure, resistance to wetting and solubility, and uniform coating of siliceous sand and silt grains suggest organic-mineral bonding to the silica or quartz surfaces. Based on visual changes during chemical extraction with bases, the organic-mineral bonding appears to be quite strong. The organic coatings tend to resist removal with H_2O_2 treatment.

Questions exist relative to the permanence of the humus rich, dark-colored anthropic epipedons. Will they gradually lose organic matter and dark color through microbial degradation over time, since enhanced carbon inputs from habitation have ceased?

The epipedons may represent a climactic characteristic resulting from the synergistic inputs of various carbon and phosphorus components due to prolonged habitation by man.

Comparisons may be made to carbon-nitrogen balances in natural cumulative soils which have not received enhanced additions of organic matter and mixing due to prolonged habitation. Cumulative soils commonly contain some allogenic organic matter which was present in the eroded sediments. Recent studies (Menzel 1980) indicated the ratio of total nitrogen in eroded materials to that in the source soils (Enrichment Ratio) decreases logarithmically as the amount of sediment increases in agricultural watersheds. This relationship indicates the allogenic organic matter present in the parent material would have a decreased rate of breakdown as burial proceeds and time increases. Jenny (1962) quantified the allogenic organic matter breakdown rate of burial sediments of the Nile River in the following manner: $dN/dT = A - Ko\ N$, where A was the nitrogen gain by fixation and Ko N were the losses due to microbial decomposition. After depositions, both nitrogen fixation (additions) and microbial decomposition (losses) occur, with losses exceeding additions. Thus, nitrogen (organic matter) tends to decrease with increased lime and burial depth. Other studies (Hole 1975) have indicated the dark-colored, humus-rich spodic horizons degraded after removal of the hemlock (*Tsuga canadensis*) forest cover which was providing the organic replenishment. Hole (1975) estimated the half-life of a spodic horizon was about 100 years following removal of the hemlock forest cover.

The dark-colored anthropic epipedons in 22It537, 22It576, and 22It590 have persisted at least 5,000-6,000 years. However, replenishment of the organic compounds by habitation additions have been maintained over the 5,000-6,000 year period until abandonment within the past few hundred years (500-300 years B.P.).

The P_2O_5 levels extractable in 1% citric acid are supposedly depictive of the phosphorus additions by man during habitation with a threshold level of 250 ppm necessary for anthropic epipedons. The P_2O_5 levels of 22It539, 22It576, and 22It590 far exceeded 250 ppm with highest levels detected in 22It576 and 22It539, respectively. Values in these two sites were several fold higher than were detected in 22It590. The highest citric acid extractable P_2O_5 levels in 22It539 and 22It576 generally occurred in the Benton component strata. In comparison, the extractable P_2O_5 levels in adjacent undisturbed off-site soils were far less than 250 ppm, which indicates that the much greater levels present in the sites were due to prolonged habitation.

Although organic phosphorous contents were much higher in the site pedons compared to adjacent off-site soils, the data were erratic and difficult to interpret. Total fractionation of the phosphorus (soil) into the discrete components for a representative pedon from Block D of Site 22It576 indicated the distribution with depth. Total phosphorus reached maximum levels at depths of 60-70 cm (23.6-27.6 in) (Benton). The non-occluded phosphorus fraction (Pnoc) comprised the largest proportion of the total phosphorus with highest values occurring at depths of 70-80 cm (27.6-31.5 in) and lowest values in the surface horizons. The non-occluded phosphorus has been associated with the aluminum and iron oxide surfaces and is available for plant use (Meixer and Singer 1985). Walker and Syers (1964) reported in a study of humid to dry soils of different ages in New Zealand on P transformations during soil development. They found the transformations consisted of the dissolution of calcium phosphates and the formation of organic and aluminum- and iron-oxide associated forms. Initially the aluminum- and iron-oxide associated forms were non-occluded, and later all forms of soil phosphorus transformed to organic and occluded forms. Recently, Meixner and Singer (1985) found organically bound phosphorus did not change systematically with time, and non-occluded phosphorus generally decreased in B horizons in California soils ranging from 300-250,000 years of age.

Based on the data of 22It576, non-occluded forms of phosphorus comprise the dominant part of the complex, followed by occluded phosphorus, calcium phosphorus, and organic phosphorus (Pnoc < Poc < Pca < Po). Due to the acid, inert nature of the original sediment comprising the parent material very low levels of calcium phosphorus were present when the sediment was deposited. The elevated levels of total phosphorus which were dominated by non-occluded form were characteristic of the sites. In an idealized pedogenesis model of phosphorus transformation, calcium P in apatite or other parent materials would weather and be transformed to organic P by plants with some of the organic P transformed to non-occluded P in the presence of iron and aluminum oxides which would then be transformed to occluded P in the crystal lattices of iron and aluminum oxides and not be available for plant uptake. The monomorphic amorphous organic matter resulting from the dissolution and precipitation of humified organic matter (DeConick et al. 1974) complexes with iron and aluminum oxides and provides the mechanism for the persistence of the non-occluded P. The monomorphic organic coating of mineral surfaces gives rise to the persistent dark color and the elevated phosphorus levels (greater than 250 ppm P extractable in 1% citric acid). The humus and sesquioxides present served as a very large "sink" for the formation of non-occluded P. Calcium-P could be provided by bones of animals and/or burials. However, the very low levels of Ca-P suggest contributions by bone were either minimal at the sites, or the Ca-P introduced was transformed readily to non-occluded P and organic P. The intermediate levels of organic P (higher than adjacent off-site soils) reflect the cultural additions of organic P from organic sources and contributions by plants present on the sites. Apparently, sufficient time has not occurred (10,000 years) or environmental conditions changed sufficiently for transformation of the non-occluded P to occluded P.

PALEOSOLS

Well-developed paleosols, with illuviated clays and compound structure, occurred in 22It539 and 22It576 at depths below 1.25 m (4.1 ft). The paleosols had yellowish brown colors in Munsell hues of 10YR in contrast to dark-colored superjacent anthropic epipedons and gleyed, reduced colors in adjacent off-site soils. The presence of well-developed paleosols containing argillic horizons with compound structure was unexpected in the floodplain setting. A prominent morphological feature of the paleosols was the occurrence of a polygonal network, with polygons separated by highly leached seams of silt and very fine sand. The presence of the paleoargillic horizons indicates advanced pedogenesis occurred over a prolonged period of stability prior to subsequent burial by sediments. Diagenetic alteration of the paleosols after burial appears to be minimal other than possible compaction and chemical infusions. The absence of a detectable antecedent surface horizon (A) and the presence of an unconformity with the anthropic epipedon overlying the paleosol suggests truncation by erosion. The high sedimentation rates of the early Holocene suggests a period of instability and widespread lateral erosion and deposition in the floodplain during that period.

Assignment of a chronological age to the paleosols of 22It576 and 22It539 presents an enigma in the absence of materials in context for radiocarbon dating. However, based on the occurrence of argillic horizons of comparable pedogenic development occurring only on stable Pleistocene surfaces in the region, a late Pleistocene or early Holocene placement seems prudent. Other than formation of the anthropic epipedons, relatively little pedogenic development was detected in the sites above the paleosols, other than lamellae (particularly 22It590) and sporadic occurrence of cambic horizons. The episodic sediment depositions and intense biopedoturbation due to habitation and intense microfloral and microbiotic activity have apparently retarded pedogenic development in the sites.

The extensive polygonal macrostructure present in the paleosols occurs in fragipan horizons of mature upland soils and has also been reported in buried paleosols of selected rivers in Mississippi (Abu-Agwa 1982). The presence of fragipans in soils has been attributed to compaction due to weight of glacial ice, permafrost, periods of desiccation (Grossman and Carlisle 1969), and to buried strata (Buntley et al. 1977). Soils with polygonal surface patterns have been reported in semiarid soils (Hugie and Passey 1964). The vesicular pores associated with polygonal surfaces and fragipans, and which were common in the paleosols of 22It539 and 22It576, have also been associated with dry conditions (Laphan 1932; Springer 1958). Micro-morphological examinations of the paleoargillic horizons indicated common bisection of existing structural domains by the polygonal cracks which suggests formation of the argillic horizon prior to development of the cracks and polygonal morphology.

Based on the pedological data obtained in this study, the following are reasonable postulates:

1. Sites 22It539 and 22It576 were stable geomorphic surfaces such as outliers of the Pleistocene valley wall or prominent levee/bar features which developed argillic horizons during the Pleistocene period.

2. Xeric conditions developed which resulted in the polygonal morphology with deeply incised desiccation cracks permeating the argillic horizon and bisecting existing structural fabric.

3. Humid conditions occurred which resulted in severe flooding and erosive truncation of the loose surface horizon down to the consolidated argillic horizon.

4. Progressive incremental sedimentation of the sites occurred over time with the aggrading stream conditions becoming less pronounced.

5. Habitation of the sites enhanced carbon inputs, mixing and associated bioperturbation, which synergistically affected soil genesis.

Grissinger et al. (1982) reported the occurrence of paleosols in stream channels near the bluff area of northern Mississippi. The paleosols had distinctive polygonal morphology and were considered to be Holocene age. Paleoclimates of a hotter and drier nature have been suggested for the region of the study area during early Holocene to mid-Holocene based on pollen and/or plant micro-fossil studies. Drier conditions have been suggested in middle Tennessee from 8,000-5,000 years B.P, (Delcourt 1979), and in southeastern

Missouri from 8,700-5,000 years B.P. (King and Allen 1977). These findings tend to support the hypothesis for the sites containing well-developed paleosols.

Similarities exist in pedogenic parameters of the buried paleosols of 22It539, 22It576, and the Pleistocene upland 22It606 which contained an argillic horizon. The argillic horizon of 22It606 tended to serve as a "basement" for habitation activity, with cultural disturbance and artifacts limited primarily to horizons located above the argillic horizon and in the upper part of the horizon. Coloration of the argillic horizon was not appreciably affected by prolonged habitation, suggesting that the well-developed argillic horizon with defined structure and illuviated fabric was existing and in place prior to habitation. A similar analogy may be applied to the paleoargillic horizons of 22It539 and 22It576. However, chemical inputs of a non-visible nature resulting from habitation left imprints in the paleoargillic horizons. Cations and phosphorus levels in the paleoargillic horizons were apparently enriched by leachate from superjacent horizons containing cultural activity. Analyses of the interior of a polygon in the paleoargillic horizon of 22It576 at a depth of 1.6 m (5.3 ft) had the following P levels: non-occluded P = 926.9, occluded P = 369.6, calcium P = 12.3, and organic P = 18.2 ppm, respectively. The elevated phosphorus content and fractional distribution are depictive of the cultural disturbance and habitation.

A conceptual model of soilscape stability for habitation based on soil/geomorphic parameters for the sites analyzed in this study may be expressed as: 22It606 > 22It539 > 22It576 > 22It621 > or < 22It622. However, other factors obviously have a bearing on the population and longevity of habitation and the resultant artifact assemblies and densities.

Although each river system differs markedly in hydrological properties and sediment characteristics, sites in other river systems in the southeastern U.S. should exhibit similar pedological features of paleosols and polygonal morphology if the proposed hypothesis has validity. If other sites are detected which have similar soil morphological features, correlation of artifact components and radiocarbon dates should clarify the chronological sequence.

SUMMARY FOR ARCHAEOLOGISTS

The soil studies focused on basic questions: were the midden mounds natural or cultural phenomena, why the thick midden was still so dark after 5,000-6,000 years of percolation and almost 300 years since active site use, and what is the description of the paleosol buried below this midden? In order to deal with these issues, a firm baseline of descriptive data had to be compiled from a representative sample of midden mound profiles and from an upland site as well. Five floodplain sites were studied, but most analytical work was done on the Poplar (22It576) and Walnut (22It539) sites which were typical midden mounds. The others investigated on a less intensive level were the Ilex (22It590), Oak and Beech (22It623 and 22It624), and Mud Creek (22It622). The upland site studied was 22It606.

Fieldwork was conducted in several visits to each site. The first visit occurred when a profile had been exposed to sterile soil either in an excavation unit or by backhoe. Chronology of the soil profile based on the archaeological information and other relevant site information was presented to the soil scientist in a briefing session prior to each fieldwork session. Fieldwork at each site included a detailed description of the soil profile (e.g. Table 50) with samples of each stratum retrieved for laboratory analysis. Off-site sampling was conducted by hand with a three-inch (7.5 cm) bucket auger or by machine with a backhoe. Off-site samples were collected on systematic transects or positional locations. In addition, conferences were held on site with the soil scientist and the archaeological staff concerning site stratification, distribution, and sequence of depositional units and the correlation of cultural components and strata. Backhoe trenches were often excavated during these conferences to answer questions, and the tracing of strata on unit profiles for scale drawings was reviewed. Usually the soil scientist visited the site several times.

The laboratory work including both physical and chemical analysis was done in the soil science laboratories of Mississippi State University. X-ray diffraction analysis was also performed on some samples.

The results of soil field and laboratory analysis will be presented below followed by an integration and interpretation. Supporting data are contained in the previous sections of this chapter.

THE WALNUT SITE (22It539)

This site was located at the headwaters of the Tombigbee near the confluence of Mackey's and Big Brown Creeks (Figure 1). It was a prominent floodplain feature approximately 80 m (264 ft) in diameter, 1.5 m (4.5 ft) in height and surrounded by creeks and wetlands (Figure 3). The deposits of the site were well-drained, reddish brown sandy loams which contrasted sharply with the adjacent poorly drained silt and clay deposits and the well-developed upland soils. The site soils were characterized by 1.25 m (4.1 ft) thick stratum of organically stained loamy soil which rested on the truncated surface of yellow-brown paleosol (Figure 11).

The dark loamy midden had been extensively altered by burrowing animals such as crawfish, earthworms, and rodents, by roots from the thick vegetation cover, and by long-term human occupation. These forces had affected almost every measure of the upper meter of the site including color, structure, soil development, texture, and chemistry. For example, in the 5,000-6,000 years of buildup, no soil horizons had developed in this zone. It it and was essentially an "A" or surface horizon.

This kind of organically stained midden has been identified and defined by soil scientists (Soil Taxonomy 1965) as an anthropic epipedon, a unique soil formed by the interaction between human and natural forces. This zone at the Walnut site was characterized by a high amount of organic matter which had coated the sand grains with humus and cemented them together into granules which water could not penetrate. It took extremely caustic bases and physical shaking finally to free the sand grains of this humic acid coating. Due to the strength of this chemical bond between the humic acid and sand grains, the organic matter could not be moved down by water percolation, and the zone remained dark in color and greasy to the touch. Bands of fine material (lamellae) were present in the lower half of the dark midden zone probably caused by poor percolation of water through this organic zone and a frequent high watertable in the floodplain. The carbon:nitrogen ratio, while varying widely, was especially concentrated in the base of the midden zone (50-150 cm or 19.7-59.1 in). This ratio may be related to the presence of fired clay and corresponds to the area in the profile of many fired clay hearths (Chapter V and Chapter X).

The paleosol beneath this midden had been eroded, and the old "A" or surface horizon had been removed exposing the "B" horizon, but otherwise it was well preserved. This paleosol was as well developed physically as the paleosols of Pleistocene age in the adjacent uplands. The paleosol indicates a long period of development during which the landscape was stable. The structure is crosscut with polygonal cracks outlined by white seams which indicate that the soil developed before the polygonal cracking took place. Chemically, the paleosol contained the highest amounts of exchangeable aluminum in the site profile which indicates extreme age and weathering.

The size of the particles in sediments of the site all reflected that it had formed naturally from discrete episodes of fluvial deposition. There was the expected sorting of coarser particles toward the bottom of the landform and finer particles toward the top. From these data and the lack of any artificially deposited strata, the formation of the landform was determined to be from natural forces. It was a "parallel bar", tear drop in cross section, with a steep side facing upstream flow and other sides tapered (Figure 3) which formed during episodic flooding. These bars are not formed along the mainstream but are scattered in the floodplain. The coarseness of the sediments and the lack of a mainstream channel are the primary indicators of these phenomena, both of which were present at the Walnut site.

All the characteristics described above contrast sharply with the surrounding soils of the floodplain or uplands. The dark midden is unique to sites intensively occupied by humans, and the paleosol is as well developed as those in the uplands which have developed in sediments which are tens of thousands of years older than those in the floodplain.

THE POPLAR SITE (22It621)

The Poplar site was located in the floodplain 24 km (14.9 mi) downstream from the Walnut site (Figure 1). It was smaller than the Walnut site, approximately 40 m (132 ft) in diameter and 75-100 cm (27.6-39.4 in) in height, and was in the same physiographic position surrounded by creeks and wetlands. The stratigraphic sequence and physical and chemical characteristics of this site mirrored that of Walnut with a few variations. The two primary strata were a 120 cm (47.3 in) thick organically stained midden resting uncomformably on the eroded surface of a paleosol (Figure 4). In this midden between 50-80 cm (19.7-31.5 in) below surface, a zone of particularly high citric acid soluble P_2O_5 was defined which could be indicative of greater site population at that time, increased length of occupation duration, or other activities during this time. This agrees well with the archaeological material recovered from this zone. The chemical tests also identified two zones (50-70 cm/ 19.7-27.6 in and 90-100 cm/35.5-39.4 in) which had greater additions of phosphorous when they were exposed surfaces, perhaps from increased site population and animal processing. At the base of the midden zone horizontal bands or lamellae had formed in the midden (Figure 4), likely due to perching of water on top of the relatively impermeable paleosol and to the deposition of fine particles. The similarity between these two sites at even small levels of detail is striking and documents that the same forces of site formation and site use were in action.

The Poplar site landform was also a parallel bar formed from natural deposition of materials from episodic floods. It was tear drop in cross section with a steep flat upstream face (north) with coarser and more consistent distribution of particles than the surrounding floodplain. Discrete depositions could be identified, and all strata had the same parent material.

THE HICKORY SITE (22It621)

While intense soil studies were not performed at the Hickory site, it is mentioned here because of its similarity to the Poplar and Walnut sites. It was located in the floodplain between these two sites approximately 5 km south of Walnut and 14.5 km (9 mi) north of Poplar (Figure 1). It was characterized by a 100-110 cm (39.4-43.3 in) thick, dark organically stained midden resting uncomformably on the truncated paleosol (Figure 17). This particular area of the floodplain was extremely low and wet due to many seep springs in the vicinity, and this combination of a relatively higher water table and the impermeable paleosol caused the upper midden to be saturated longer than any other midden mound investigated. This probably caused a 50 cm (19.7 in) thick zone of manganese concretions to form within the midden above the paleosol. Although no intensive soil studies were performed, the archaeological investigations at this site indicated that the deposits likely were chemically and physically very similar to the Poplar and Walnut sites. The Hickory site landform was also a floodplain parallel bar similar in shape and orientation to Walnut and Hickory.

THE ILEX SITE (22It590)

The Ilex site was located in the floodplain on a terrace of Mackey's Creek approximately 5 km (3.1 mi) upstream from the Walnut site (Figure 1). The site was in a different position than the others investigated in that it was tangent to the valley wall and had formed from overbank deposition as well as colluvium washing down the steep valley wall. The sediments contained more sand, and there was no paleosol beneath the 100-120 cm (39.4-47.3 in) thick organically stained midden (Figure 14). The sandy strata underlying the midden also contained lamellae similar to those at Poplar and Ilex sites.

There was a lateral gradient (north-south) to the chemical testing results indicating perhaps greater age at the southern end of the site adjacent to the valley wall and greater cultural alteration at the northern end of the site. Some reworking of the sediments was also indicated. It should be understood that at least ten lateral meters of the site at the the northern end site had been removed prior to our investigations. The chemical and physical characteristics of the organically stained midden were the same as the Walnut and Poplar, including the humic acid coated sand grains and the higher amounts of calcium, organic matter, and potassium. The absence of the paleosol at this site may be due either to erosion or to the lack of suitable environment and materials for formation.

SITE 22IT606

This was the only non-floodplain site included in the soil studies. It was on a high (15-20 m/49.5 ft) terrace outlier overlooking the floodplain within 1 km (.62 mi) of the Mud Creek site and 2 km (1.24 mi) of the Hickory site. It is different from the floodplain sites stratigraphically, chemically, and physically. The soils of this site are typical of mature upland areas and include a buried Pleistocene paleosol. Only the upper 27 cm (10.6 in) had been culturally altered, and this may have been through the addition of agricultural fertilizers rather than prehistoric human occupation. The paleosol was buried 100-150 cm (39.4-59.1 in) and was fully developed prior to human habitation. Below 27 cm (10.6 in), the upper zone was not measurably different from the surrounding area.

The paleosol at this site was composed of a different parent material than the zones above it and was the product of a different depositional environment. As with the floodplain sites, however, the paleosol had been eroded with the "A" horizon removed, and younger, unrelated sediments were deposited later.

THE MUD CREEK SITE (22It622)

This was a small mound in the Tombigbee floodplain approximately 6 km (3.7 mi) north of the Beech and Oak sites (Figure 1). It was approximately 40 m (132 ft) in diameter and 50-75 cm (19.7-29.6 in) in height and tear drop in cross section. The stratigraphy revealed an organically stained loamy midden which had severe bioturbation (animal burrowing). The stratigraphic sequence did not include the paleosol. However, this site was only tested and did not include intensive investigations. The chemical and physical properties of this site revealed less alteration than any other site studied in the floodplain, revealing only a 30 cm (11.8 in) culturally altered zone or midden. This documents that some well-drained elevations in the floodplain were not intensively occupied.

THE BEECH AND OAK SITES (22It623 and 22It624)

Although these two sites were originally separated when identified, they are adjacent fragments of the same landform in the floodplain of the Tombigbee and are considered one site for analytical purposes. This site was located between the Walnut and Poplar, approximately 6 km (3.7 mi) north of Poplar (Figure 1). The site landform was a levee remnant which has been bisected by a small tributary stream. The levee was formed by overbank deposition from the east where there is an abandoned channel segment of a major stream, likely the Tombigbee which today is ca. 500 m (1,650 ft) to the west.

The primary strata are in a 120 cm (47.3 in) thick organic-stained midden zone which rests on the yellow-brown truncated paleosol (Figures 18 and 19). The midden at this site is dark organically stained for only 50 cm (19.7 in) with a lighter brown lower half. This differs from the previously discussed sites, and it does not meet the criteria for an anthropic epipedon. The contact between the paleosol and the midden was characterized by manganese concretions, especially at the base of organically enriched pit features. As at the Hickory site, only 9 km (5.6 mi) north, the concretions are likely the result of organically stained soil saturated much of the time by a fluctuating water table perched on the impermeable paleosol.

There were no identifiable zones of chemical anomalies in the organically stained midden such as those identified at the Poplar and Walnut sites, indicating that human occupation had been less intense at this site than those previously described. This conforms with the cultural material and features recovered at the Beech and Oak sites.

DISCUSSION AND INTERPRETATION OF THE SOIL ANALYSIS

The results of soil, chemical, and physical analysis are sufficient to address specific research questions posed in this study as well as more general issues of soil development in archaeological sites in a floodplain. New information produced in this study will enable both the archaeologists and soil scientists to understand the interaction between natural and cultural forces in the floodplain.

The first question about how the midden mound landforms developed has been firmly answered. They are natural and were formed by fluvial deposition of sediments. Four sites known as midden mounds (Poplar, Walnut, Hickory, and Mud Creek) were parallel bars which formed away from the mainstream during floods effecting the entire floodplain. All fit the classic description of tear drop cross section with a steep upstream face and tapered edges, consistent coarse sediments and gradation of fine particles up the profile. Two others were formed by overbank deposition (Ilex and Beech/Oak). These sites exhibited classic overbank sedimentation characteristics such as thickness in the strata adjacent to the stream and a linear shape paralleling the stream. No artificial site construction was detected in any of these studies.

The research into the question of why the midden which is so characteristic of these sites still was still so dark after up to 6,000 years produced a wealth of information which not only addressed this issue, but the larger issue of the characteristics of the midden zone (or anthropic epipedon). For the past several decades, soil scientists have realized that prolonged human habitation on a site alters the soil development process and can impart unique characteristics which persist for long periods. These characteristics are primarily related to the introduction of organic material into the soil which masks and alters the natural processes of soil development, weathering, erosion, and biological activity. In addition, prolonged habitation by humans can destroy previous development in the soil. The organic materials introduced into the soil by people were well decomposed, and the resulting organic compounds, especially humus, actually formed a mineral bond with the soil particles which prevented natural wetting and swelling and enhanced cementation. This well-developed granular soil structure and the tendency to repel water were the prominent characteristics of the midden zones. This strong bonding inhibits the movement of humic organic compounds down the soil profile. This promotes an artificial buildup of a "surface" horizon, and the midden zone is actually an "A" soil horizon which is dark in color due to the presence of organics.

The unusually thick buildup of an organic zone in the midden mounds has been enhanced by the two factors: 1) continual deposition of new sediments to the floodplain landforms each year and 2) the bonding of organic compounds coating the sand matrix of the soil profile. These factors combine to produce a growing midden zone that is excluded from the natural forces of leaching and percolation. These middens are "greasy," ever-growing "lumps" resulting from intense habitation occupation in the floodplain, which, as far as soil science can detect, are almost permanent fixtures in the landscape. Erosion has been the main effective force in decreasing the size of these sites.

The chemical analysis of the midden zone documented discrete concentrations of some chemicals in some of the midden profiles. This included a high carbon/nitrogen ratio at the Walnut site between 50-150 cm (19.7-59.1 in) and two zones of high phosphate at the Poplar site. Due to the poor movement of organic compounds through this midden zone, these zones of chemical anomalies could well be related to an increase in the site population and/or length of occupation time.

Some movement of fine particles through the midden zone was documented, however, by the presence of lamellae or bands of fine particles in the lower half of at the bottom of the midden zone at several sites. These were were also noted at several sites downstream in the vicinity of Amory, Ms (Bense 1982). The cause of the lamellae is not well understood, but it is suspected that they are caused by dropout of fine particles (silt and clays) moving down the profile due to perched high water tables in the soil profile, or they represent periods of stability and pedogenic development.

One of the most surprising findings of the soil studies in this project was the paleosol buried beneath the midden zone in the floodplain. This phenomenon had been recently discovered in some archaeological studies in floodplains in the Midwest and Southeast. However, this information was not yet well known or in the general literature at the initiation of this study. Actually, soil scientists had considered the floodplain far too active and the sediments too young to have any well-developed soils. So, when the "yellow brown" zone below the dark midden zone proved to have structural development, illuviated clays, and chemical weathering equal to upland Pleistocene soils of much greater age than the Holocene floodplain deposits, and this zone contained cultural material no older than 10,000-12,000 years, it was cause for great interest by the soil scientist.

Some of the first questions posed by the soil consultant related to the integrity of the cultural material and the age of the temporal markers contained in this zone. Unfortunately, there was no reliable datable material in the paleosol, although several attempts were made to recover charcoal for radiocarbon dating. Whole 1x1 m (3.3x3.3 in) units were fine-screened, and the charcoal flakes were removed and sent for dating, but the dates obtained varied widely and did not correlate with the consistent dates received for the midden zone. The best documentation of the age of the paleosol is from the consistent radiocarbon dates of 6,500-7,000 B.P. at the base of the midden and the inclusion of stratified temporally sensitive artifacts. The truncated upper 20-40 cm (7.9-15.8 in) of the paleosol contained Eva-Morrow Mountain projectile point/knives which have been dated in the adjacent Tennessee Valley drainage to 6,500-8,000 B.P. (Chapman 1975; Cridlebaugh 1977; Hofman 1984). Below these markers, usually in the central portion of the paleosol, Kirk projectile point/knives predominated. This marker has been consistently dated as occurring in the mid-South between 9,000-10,000 B.P. (Chapman 1977). Between the Kirk and Eva-Morrow Mountain zone usually were transitional forms such as Cypress Creek and Wade projectile point/knife types which probably were made between 8,000-9,000 B.P. There usually were no in situ projectile point/knives below the Kirk, and the lower half of the paleosol was culturally sterile. From these indirect data, the date of the sediments making up the upper half of the paleosol are approximately 10,000 years old, and the lower half must therefore be older, perhaps dating to the late Pleistocene.

To document the integrity of the artifactual material in the paleosol, piece plotting of all specimens was performed at the Walnut, Poplar, and Hickory sites. This documented that the specimens were not size-sorted from secondary fluvial deposition and that specimens crosscut the structural features, indicating that the soil developed with the artifacts in situ. In addition, the angle (or dip) of the specimens in the paleosol was relatively flat indicating they were not laid down by running water. Therefore, the specimens were incorporated into the sediments by people as they built-up during flooding.

Soil development follows sediment deposition, and the extent of development reveals certain characteristics of the environment in which it developed. From the study of the paleosol structure beneath the midden mounds, it can be inferred from the advanced level of development that the landscape was stable during development, i.e. after the sediments were laid down and before they were truncated (post-7,000 B.P.). In addition, the network of polygonal cracks intersected the soil structure and therefore must have occurred after development took place. This reflects a period of environmental desiccation. This information suggests the following scenario:

1. The sediments of the paleosol were deposited on a swampy and possibly eroded floodplain or eroded stranded surface of Pleistocene outliers in a relatively high energy fluvial environment during the late Pleistocene to approximately 7,000 B.P.

2. Depositional rates steadily decreased, and a well-developed soil formed before 6,500 B.P. This is probably the onset of the Altithermal (or Hypsithermal) climatic episode.

3. A period of desiccation occurred in which the soil actually cracked forming the polygonal network in the soil. This probably correlates with the xeric maximum of the Altithermal climatic episode.

4. Catastrophic flooding took place approximately 6,500 B.P. and removed the A horizon of the soil followed by regular deposition of fluvial deposits which continues to the present day. This likely correlates to the onset of modern conditions (Medithermal) and the end of the xeric Altithermal climatic episode. Human occupation of these landforms increased in intensity at or before this time and continued throughout the prehistoric period, greatly altering the soil and impeding soil development.

From the information produced in this detailed analysis of the soil from six archaeological sites in the floodplain of the Tombigbee Valley, much has been learned about soil development processes, landscape evolution, late Pleistocene and Holocene climatic episodes, and the effect of intense human occupation on the soil. The three-part Holocene climatic sequence is consistently reflected in the floodplain sequence of deposition and development of soils. Since the Altithermal climatic episode, humans have occupied these high, well-drained knolls in the floodplain with consistent intensity, drastically altering the soil.

CHAPTER VII BOTANICAL STUDIES

As part of the interdisciplinary approach to the study of the remains from these eleven archaeological sites, botanical studies were also performed. These studies included: 1) an analysis of existing vegetation on or near several sites investigated to quantify the "modern" vegetation composition in the study area; 2) an assessment of the vegetation history in the mid-South from the late Pleistocene to the present to better understand plant community dynamics; and 3) an analysis of plant remains from the archaeological sites investigated. Vegetation history was derived largely from palynological studies performed in wetlands near the study area. Botanical information complements the geomorphological studies to produce a holistic perspective of the effect of the climatic changes of the Holocene on the landscape and plant communities in the Upper Tombigbee Valley.

Plant remains research addressed questions relating to subsistence, site environment, and relative density of occupation. Most of the botanical remains were charred plant fragments. Several attempts were made to recover pollen; however, it was generally not preserved in the well-drained midden soils. Pollen was found in one site (Ilex: 22It590), and it produced interesting information on the Early Archaic environment at this locality.

Most of the information produced by the botanical studies concerns use patterns of plants. Unfortunately, charred plant remains represent a skewed sample of the range of plants used in the past and they may be limited to 10% of the total utilized flora. Although these remains represent only a small fraction of the utilized plants, analysis indicates that there were patterned changes through time.

VEGETATIONAL HISTORY OF THE MID-SOUTH

The present climate of northeast Mississippi is temperate and humid with mild winters, warm summers, and abundant precipitation. Rainfall distribution is usually higher in winter and spring months and lowest during the fall season.

Past environmental conditions in the mid-South have been studied primarily through palynology. At Nonconnah Creek, Tennessee near Memphis (ca. 160 km: 100 mi northwest of this study area), Delcourt and Delcourt (1979) indicate that the climate was colder during the late Pleistocene. A series of samples representing 23,000-13,000 years B.P. shows spruce (Picea spp.) dominating, with fir (Abies spp.) and larch (Larix spp.) present. Continuous representation of ironwood/hop-hornbeam (Carpinus caroliniana - Ostrya virginiana), ash (Fraxinus spp.), birch (Betula spp.), beech (Fagus spp.), maple (Acer spp.), cottonwood (Populus spp.), willow (Salix spp.), elm (Ulmus spp.), viburnam (Viburnam spp.), and walnut (Juglans spp.) pollen supports their hypothesis that dissected terrain adjacent to north-south trending rivers throughout the southeastern United States served as refuge areas for deciduous tree species during the full glacial period.

The later glacial and post-glacial history of south-central United States vegetation may be traced from palynological data obtained from numerous sites south of the glacier's edge. As the climate ameliorated, cool temperate mixed Mesophytic forest species spread north along the Appalachian Mountains and the Allegheny and Cumberland Plateaus. By 5,000 years B.P. the warming and drying trends of the Hypsithermal had their maximum effect, and mesophytic species became restricted to northern latitudes and high altitudes, while the prairie spread as far east as eastern Missouri, and xeric oak-hickory-ash forest was present in central Tennessee.

After 5,000 years B.P., southern pine (Pinus) species became abundant on the Coastal Plain due to the increased dominance of the tropical maritime airmass from the Gulf of Mexico. At the southern end and west of the Appalachian Mountains, however, a mosaic of deciduous and coniferous forest developed and persists today. Near Columbus, Ms, for example, sweetgum (Liquidambar styraciflua) became more important after 2,500 B.P., tupelo (Nyssa sylvatica) and black gums (N. aquatica) increased until 2,300 B.P., and pine has increased continuously since 2,500 B.P.

Today, in the study area, the uplands vegetation is dominated by short-leaf (P. echinata) and loblolly (P. taeda) pines with blackjack (Quercus marilandica), post (Q. stellata), Spanish (Q. falcata), and white (Q. alba) oaks on the lower slopes. Common associated on the ridges are the rock chestnut (Q. prinus) and black (Q. velutina) oaks, dogwood (Cornus florida), and hickories (Carya spp.). In the bottoms, white (Q. alba), water (Q. nigra), and willow (Q. phellos) oak; sycamore (Platanus occidentalis); beech (Fagus grandifolia); maple (A. rubrum); black gum; sweet gum; and cypress (Taxodium distichum) are common. Associate species include hackberry (Celtis sp.), ash, redbud (Cercis canadensis), great-leaved magnolia (Magnolia macrophylla), silver bell (Halesia carolina), storax (Styrax americana), paw-paw (Asimina triloba), and red birch (Betula nigra).

Based on this historical summary, it appears that from 10,000-5,500 B.P., known culturally as the Early and Middle Archaic period, the environment shifted from a forest of cool temperate species to a forest dominated by xeric species on the ridges and warm temperate species in the floodplains. The environment of the more recent cultural periods (Late Archaic, Gulf Formational, Woodland, and Mississippian) differed very little from today's: a forest dominated by mockernut (C. tomentosa), bitternut (C. cordiformis), pignut (C. glabra), shagbark (C. ovata), and pale (C. pallida) hickories; white, post, scarlet (Q. coccinea), Spanish, black, and blackjack oaks; loblolly and short-leaf pines.

A study of potential plant resources (Sheldon 1981) in these forests indicates that there are twice as many genera useful to humans in floodplain communities than in the uplands. These include food sources such as hickory and beech nuts, acorns, red mulberries (Morus rubra), tupelo gum, grapes (Vitis spp.), and beauty berry fruits (Callicarpa americana); beverage sources including holly (Ilex spp.) and sumac (Rhus copallina and R. glabra); dyes from Virginia creeper (Parthenocissus quinquefolia), greenbriar (Smilax spp.), hickory, tulip poplar (Liriodendron tulipifera); numerous herbal medicines; and several taxa used for construction purposes or crafts such as: cane (Arundinaria gigantea), ash, white oak, cypress, and elm.

BOTANICAL ANALYSIS OF ARCHAEOLOGICAL MATERIAL

The floral remains from eight of the archaeological sites investigated in this project were studied and are reported here. Of these, five were located in or adjacent to the floodplain knolls.

Analysis was conducted on samples from control columns and occasional general levels of the midden as well as from selected features that were recovered by flotation methods. The selection of samples to be analyzed was made jointly by the archaeological staff and archaeobotanical consultant. The plant remains plus information on weight and volume of the matrix were sent to the archaeobotanist after hand sorting by the general laboratory staff. The total volume of all features was floated, and except in individually specified cases, the analysis presented below represents the total floral content of each feature. Generally, the concentration of plant remains from midden control block levels was less than 1.0% weight/volume; and in features it varied from 0.001% to greater than 4%.

Each botanical sample was examined and sorted under a Bausch and Lomb 10-70 power dissecting microscope. Fragments of involucre or pericarp of hickory or oak and wood (xylem) were weighed on an O'haus triple-beam balance.

The wood was identified to the genus level by comparison to specimens in the comparative collection at Auburn University-Montgomery, to a dicot wood key (King n.d.), and to illustrations in The Structure of Wood (Jane 1959). Unfortunately, identification to the species level requires preparation of microscope slides and examination at a much higher magnification, and this taxonomic effort was not undertaken in this study. Even then, within some genera (e.g., Pinus, Carya, and Querus), species are indistinguishable. Because many fragments are too small to identify below the class level (Gymnospermae or Angiospermae), any specific sample may include more genera than were identified during this analysis.

Seeds were identified by comparison to those in the comparative collection at Auburn University-Montgomery and by reference to a number of manuals (Eickmeier 1974; Harlow 1959; Martin and Barkley 1973; Radford, Ahles, and Bell 1968; Symonds 1958). The numbers of seeds contained in each sample were counted during analysis.

Samples from eight sites were included in this study. This soil (8,290.8 liters) contained 2,727.4 grams of floral material and 3,894 seeds and fern spores (Tables 91 and 92). Most (90.3%) plant materials were from feature context, and the remainder (9.7%) came from midden. The amount of soil analyzed from each site was not standard, and ranged from 3,588.5 liters at the Beech and Oak site to 134 liters of soil from the Aralia site. The results of this analysis for each site studied follows.

TABLE 91
Identified plant remains totaled by site.

Site/ Provenience	Hickory	Acorn	Wood	Seed	Total
	[#] g (%)	[#] g (%)	g (%)	#	g
22It539					
Feature	810.3 (98.5)	[13] 0.4 (0.05)	12.2 (1.5)	21	822.9
Midden	72.0 (98.1)	[9] 0.1 (0.10)	1.3 (1.8)	4	73.4
Total	882.3 (98.4)	[22] 0.5 (0.06)	13.5 (1.5)	25	896.3
22It576					
Feature	392.7 (91.8)	[54] 3.3 (0.8)	31.7 (7.4)	100	427.7
Midden	[82] 71.4 (90.4)	[30] 0.1 (0.1)	6.8 (8.7)	1	78.3
Total	[82] 464.1 (91.7)	[84] 3.4 (0.7)	38.5 (7.6)	101	506.0
22It590					
Feature	394.5 (84.2)	3.4 (0.7)	70.6 (15.1)	887	468.5
Midden	16.8 (92.8)	[12] 0.1 (0.6)	1.2 (6.6)	1	18.1
Total	411.3 (84.5)	[12] 3.5 (0.7)	71.8 (14.7)	888	486.6
22It621					
Feature	39.2 (90.7)	0.3 (0.7)	3.7 (8.6)	6	43.2
Midden	3.1 (42.5)	0.1 (1.4)	4.1 (56.2)	10	7.3
Total	42.3 (83.8)	0.4 (0.8)	7.8 (15.4)	16	50.5

TABLE 91
Identified plant remains totaled by site (continued).

Site/ Provenience	Hickory		Acorn		Wood	Seed	Total
	[#]	g (%)	[#]	g (%)	g (%)	#	g
22It623/ 22It624							
Feature		352.8 (94.6)		12.3 (3.3)	8.1 (2.2)	634	373.2
Midden		9.8 (24.3)		0.2 (0.5)	30.4 (75.2)	2	40.4
Total		362.6 (87.7)		12.5 (3.0)	38.5 (9.3)	636	413.6
22It606							
Feature		87.9 (30.0)		32.1 (10.9)	122.3 (41.7)	537	293.2
22It563							
Feature		22.1 (61.9)	[25]	1.0 (2.8)	12.6 (35.3)	901	35.7
Midden	[99]	10.8 (23.7)	[134]	0.8 (1.8)	33.9 (75.5)	790	45.5
Total	[99]	32.9 (40.5)	[159]	1.8 (2.2)	46.5 (57.3)	1,691	81.2
Grand Total							
Feature	[82]	2,099.5 (85.2)	[92]	52.8 (2.1)	261.2 (10.6)	3,086	2,464.4
Midden	[99]	183.9 (70.0)	[185]	1.4 (0.5)	77.7 (29.5)	808	263.0
Total	[181]	2,283.4 (83.7)	[277]	54.2 (2.0)	338.9 (12.4)	3,894	2,727.4

THE WALNUT SITE (22It539)

The Walnut site was a mound, situated 600 m (1,980 ft) west of the valley escarpment, which rose 1.9 m (6.3 ft) above the surrounding floodplain (Figure 6). This site had been occupied intermittently from the Early through Late Holocene. Flotation samples from 158.3 liters of soil from nine features and two midden control blocks were analyzed (Appendix II: Table 1). This included five levels from Block A and three levels in Block B. The total weight of identified floral material was 896.3 grams; 73.4 grams from the midden and 822.9 grams from the features. The charred botanical remains consist primarily of hickory nutshells and wood fragments.

The results of midden sample analysis revealed that hickory nutshell dominated the floral remains (98.4%) with a range of (81.3-98.9%). The plant remains in the midden samples were similar throughout. Acorn was present in three of the eight samples, and wood was present in seven, although in small amounts (0.1%). Three fern spores and one pokeweed (Phytolacca americana) seed were also recovered from the Benton midden samples. Hickory nutshells were slightly more abundant in Block B (98.9%) than Block A (95.7%).

Nine features were studied in the floral analysis: three Middle Archaic prepared areas with multiple hearths (Features 6, 73, and 120), two Middle Archaic single hearths (Features 95 and 117), three Middle Archaic pits (Features 9, 93, and 142), and one botanical cluster from the mixed Middle and Late Archaic periods (Feature 94).

Feature 142, a Benton horizon pit, contained more botanical material (334.8 g) than the other features; however, only 10% could be analyzed. This sample was dominated (99.2%) by hickory nutshell fragments, but also contained a grape seed, a persimmon fragment (Diospyros virginiana), and hardwood fragments.

TABLE 92
Floral remains by provenience by site.

Site Provenience	Volume	Hickory	Acorn	Wood	Seed	Other	Total
	l	[#] g (%)	[#] g (%)	[#] g (%)	#	#	g
22It539							
Feature 94 (Mixed Middle-Late Archaic Botanical Cluster)	2.2	89.5 (99.7)	0	0.3 (0.3)	1	1	89.8
Feature 6 (Middle Archaic Benton Prepared Area)	8.0	14.0 (96.6)	1 (0.7)	0.5 (3.4)	0	0	14.6
Feature 73 (Middle Archaic Sykes-White Springs/Benton Prepared Area)	21.2	159.4 (99.9)	0	0.2 (0.1)	2	0	159.6
Feature 120 (Middle Archaic Sykes-White Springs Prepared Area)	30.0	86.6 (99.6)	0.1 (0.1)	0.9 (1.0)	4	0	87.6
Feature 117 (Middle Archaic Sykes-White Springs Hearth)	13.0	35.1 (86.2)	0	5.6 (13.8)	1	0	40.7
Feature 95 (Middle Archaic Sykes-White Springs Hearth)	17.1	20.9 (98.6)	[7] 0.1 (0.5)	0.2 (0.9)	0	0	21.2
Feature 9 (Middle Archaic Benton Pit)	11.5	33.0 (95.7)	[1] 0	1.5 (4.3)	1	0	34.5
Feature 142 (Middle Archaic Benton Pit)	32.0	332.2 (99.2)	[1] 0.1 (0.03)	2.5 (0.7)	2	0	334.8
Feature 93 (Middle Archaic Pit)	9.8	39.6 (98.8)	[4] 0	0.5 (1.2)	2	1	40.1
Subtotal, Features	144.8	810.3 (98.5)	0.4 (0.05)	12.2 (1.5)	13	2	822.9
Block A Midden	6.5	17.7 (95.7)	0.1 (0.5)	0.7 (3.8)	3	1	18.5
Block B Midden	7.0	54.3 (98.9)	[9] 0 (0.0)	0.6 (1.1)	1	19	54.9
Subtotal, Midden	13.5	72.0 (98.1)	[9] 0.1 (0.1)	1.3 (1.8)	4	20	73.4
Total, 22It539	158.3	882.3 (98.4)	0.5 (0.6)	13.5 (1.5)	17	22	896.3

TABLE 92

Floral remains by provenience by site (continued).

Site Provenience	Volume	Hickory	Acorn	Wood	Seed	Other	Total
	l	[#] g (%)	[#] g (%)	[#] g (%)	#	#	g
22It576							
Feature 5 (Gulf Formational Hearth)	16	0.1 (1.1)	0	9.0 (98.9)	67	13	9.1
Feature 26 (Middle Archaic Benton Pit)	2	1.3 (92.9)	0	0.1 (7.1)	0	4	1.4
Feature 71 (Middle Archaic Sykes-White Springs Pit)	8	8.1 (90.0)	[2] 0	0.9 (10.0)	17	0	9.0
Feature 85 (Middle Archaic Sykes-White Springs Pit)	178	68.7 (95.7)	1.1 (1.5)	2.0 (2.8)	0	6	71.8
Feature 98 (Middle Archaic Sykes-White Springs Pit)	104	9.4 (85.4)	0.3 (1.5)	1.3 (11.8)	0	1	11.0
Feature 49 (Middle Archaic [Benton?] Prepared Area)	?	140.4 (96.1)	0.7 (0.5)	5.0 (3.4)	5	13	146.1
Feature 77 (Middle Archaic Sykes-White Springs Hearth)	?	2.6 (92.9)	[3] 0	0.2 (7.1)	0	0	2.8
Feature 90 (Middle Archaic Eva Pit)	?	32.9 (90.4)	[3] 0.2 (0.6)	3.3 (9.1)	2		36.4
Feature 111 (Early Archaic Pit)	146	34.4 (93.5)	0.4 (1.1)	2.0 (5.4)	0	2	36.8
Feature 110 (Early Archaic Pit)	?	5.8 (89.2)	[2] 0	0.7 (0.8)	0	0	6.5
Feature 112 (Early Archaic Pit)	?	1.4 (87.5)	[1] 0	0.2 (13.5)			1.6
Feature 114 (Early Archaic Pit)	?	1.2 (92.3)	[7] 0	0.1 (7.7)			1.3
Feature 117 (Early Archaic Pit)	?	4.4 (80.0)	[16] 0	1.1 (20.0)			5.5

TABLE 92

Floral remains by provenience by site (continued).

Site Provenience	Volume	Hickory	Acorn	Wood	Seed	Other	Total
	l	[#] g (%)	[#] g (%)	[#] g (%)	#	#	g
22It576							
Feature 24 (Unaffiliated Pit)	3	[107] 0.7 (53.8)	0	0.6 (46.2)	1	0	1.3
Burial 3 (Middle Archaic Benton)	8	[124] 4.7 (88.7)	[1] 0.1 (1.9)	0.5 (9.6)	0	0	5.3
Burial 4 (Middle Archaic Benton)	5	3.9 (88.6)	[11] 0.1 (2.3)	0.4 (9.1)	0	56	4.4
Burial 11 (Middle Archaic Benton)	176	71.5 (97.4)	[4] 0 (0.4)	3.6	0	5	75.5
Burial 12	?	1.2 (63.2)	[4] 0	0.7 (26.8)	0	0	1.9
Burial 14 (Middle Archaic Benton)	?	1.15 (63.8)	[4] 0	0.65 (36.1)	0	0	1.8
Subtotal, Features	646+?	[231] 401.05 (91.8)	[58] 3.3 (0.8)	32.35 (7.4)	92	100	429.5
Block A Midden	9	8.8 (97.8)	[4] 0.1 (1.0)	0.2 (2.2)	0	0	9.1
Block B Midden	9	[77] 1.0 (76.9)	0	0.3 (23.1)	0	0	1.3
Block C Midden	9	4.0 (95.3)	0	0.2 (4.7)	0	0	4.2
Block D Midden	40	[5] 57.6 (82.5)	[26] 0	6.1 (17.5)	112	1	63.7
Subtotal, Midden	67	[82] 71.4 (91.2)	[30] 0.1 (0.1)	6.8 (8.7)	112	1	78.3
Total, 22It576	713+	[313] 472.45 (91.7)	[88] 3.4 (0.7)	39.15 (7.6)	204	101	507.8
22It590							
Feature 6 (Middle Archaic [Eva?] Pit)	19.3	10.7 (14.3)	0.9 (1.2)	63.3 (84.5)	1	0	74.9
Feature 8 (Middle Archaic Pit)	393.6	203.8 (98.4)	1.2 (0.6)	2.2 (1.1)	5	0	207.2
Feature 9 (Middle Archaic Benton? Rock Cluster)	2.0	4.2 (97.7)	0	0.1 (2.3)	0	0	4.3
Feature 13 (Unaffiliated Pit)	10.0	3.1 (94.0)	0.1 (3.0)	0.1 (3.0)	4		3.3
Feature 16 (Unaffiliated Pit)	192.0	57.7 (96.6)	0.4 (0.7)	1.6 (2.7)	0	0	59.7

TABLE 92
Floral remains by provenience by site (continued).

Site Provenience	Volume l	Hickory [#] g (%)	Acorn [#] g (%)	Wood [#] g (%)	Seed #	Other #	Total g
22It590							
Feature 17 (Unaffiliated Pit)	256.8	99.5 (97.9)	0.6 (0.6)	1.5 (1.5)	6		101.6
Feature 18 (Unaffiliated Pit)	165.6	15.5 (88.6)	0.2 (1.1)	1.8 (10.3)	871	0	17.5
Subtotal, Features	1,039.3	394.5 (84.2)	3.4 (0.7)	70.6 (15.1)	887	0	468.5
Block A-Z Midden	9.0	16.8 (92.8)	[12] 0.1 (0.6)	1.2 (6.6)	1	2	18.1
Total, 22It590	1,048.3	411.3 (84.5)	3.5 (0.7)	71.8 (14.7)	888	2	486.6
22It621							
Feature 4 (Early Archaic Pit)	72.0	12.5 (88.6)	0.1 (0.7)	1.5 (10.6)	2	0	14.1
Feature 3 (Unaffiliated Pit)	44.0	4.3 (81.1)	0.1 (1.9)	0.9 (17.0)	0	0	5.3
Feature 6 (Unaffiliated Pit)	66.0	22.4 (94.1)	0.1 (0.4)	1.3 (5.5)	1	0	23.8
Subtotal, Features	182.0	39.2 (90.7)	0.3 (0.7)	3.7 (8.6)	3	0	43.2
Block D Midden	1,300.0	3.1 (42.5)	0.1 (1.4)	4.1 (56.2)	10	0	7.3
Total, 22It621	1,482.0	42.3 (83.8)	0.4 (0.8)	7.8 (15.4)	13	0	50.5
22It623/22It624							
Feature 9 (22It623) (Late Archaic Pit)	57	4.4 (95.7)	0.1 (2.2)	0.1 (2.2)	0	0	4.6
Feature 11 (22It623) (Late Archaic Pit)	169	13.2 (98.5)	0.1 (0.7)	0.1 (0.7)	0	0	13.4
Feature 14 (22It623) (Late Archaic Compound Pit)	704	27.0 (94.1)	0.1 (0.3)	1.6 (5.6)	3	1	28.7
Feature 1 (22It624) (Late Archaic Pit)	100	26.7 (97.8)	0	0.6 (2.2)	6	0	27.3
Feature 15 (22It624) (Middle-Late Archaic Pit)	538	33.4 (97.7)	0.1 (0.3)	0.7 (2.0)	1	0	34.2

TABLE 92
Floral remains by provenience by site (continued).

Site Provenience	Volume	Hickory	Acorn	Wood	Seed	Other	Total
	l	[#] g (%)	[#] g (%)	[#] g (%)	#	#	g
22It623/22It624							
Feature 7 (22It624) (Middle Archaic Benton Pit)	908.5	201.6 (93.0)	11.6 (5.4)	3.5 (1.7)	7	8	216.8
Feature 9 (22It624) (Mixed Late Archaic Mississippian Pit)	299	19.7 (95.2)	0.2 (1.0)	0.8 (3.9)	618	0	20.7
Feature 2 (22It623) (Unaffiliated Pit)	754	25.4 (98.1)	0.1 (0.4)	0.4 (1.5)	1	0	25.9
Feature 4 (22It624) (Unaffiliated Pit)	9	1.4 (87.5)	0	0.2 (12.5)	0	0	1.6
Subtotal, Features	3,538.5	352.8 (94.6)	12.3 (3.3)	8.1 (2.2)	636	8	373.2
Block A (22It623) Midden	20	3.3 (70.2)	0.2 (4.3)	1.2 (25.5)	2	0	4.7
Block A (22It624) Midden	30	6.5 (18.2)	0	29.2 (81.8)	0	5	35.7
Subtotal, Midden	50	9.8 (24.3)	0.2 (0.5)	30.4 (75.2)	2	5	40.4
Total, 22It623 & 22It624	3,588.5	362.6 (87.7)	12.5 (3.0)	38.5 (9.3)	638	13	413.6
22It606							
Feature 18 (Late Woodland/ Mississippian Pit)	250.0	42.0 (31.5)	2.5 (1.9)	38.1 (28.5)	112	50.9	122.5
Feature 19 (Late Woodland/ Mississippian Pit)	8.8	2.1 (1.6)	[2] 0 (0)	0.4 (0.3)	94	0	2.5
Feature 20 (Late Woodland/ Mississippian Pit)	476.8	7.9 (8.1)	28.6 (29.4)	60.7 (62.4)	70	11	97.2
Feature 28 (Middle Archaic Sykes-White Springs Pit)	182.9	18.3 (96.3)	0.1 (0.5)	0.6 (3.1)	2	0	19.0
Feature 30 (Mixed Late Archaic Henson Springs Pit)	69.0	1.5 (30.6)	0.5 (10.2)	2.9 (59.2)	121	2	4.9

TABLE 92

Floral remains by provenience by site (continued).

Site Provenience	Volume	Hickory	Acorn	Wood	Seed	Other	Total
	l	[#] g (%)	[#] g (%)	[#] g (%)	#	#	g
22It606							
Feature 45 (Late Woodland/ Mississippian Pit)	178.6	16.1 (44.6)	0.4 (1.1)	19.6 (54.3)	138	3	36.1
Total, 22It606	1,167.0	87.9 (30.0)	[2] 32.1 (10.9)	122.3 (41.7)	537	16	293.2
22It563							
Feature 10 (Henson Springs Stain)	16.0	1.1 (23.9)	[10] 0.2 (4.3)	3.3 (71.7)	34	12	4.6
Feature 11 (Henson Springs Stain)	12.0	21.0 (67.5)	[15] 0.8 (2.6)	9.3 (29.9)	877	2	31.1
Subtotal, Features	18.0+	22.1 (61.9)	[25] 1.0 (2.8)	12.6 (35.3)	901	14	35.7
Block A Midden	80.0	2.6 (10.4)	[64] 0.6 (2.4)	21.8 (87.2)	287	3	25.0
Block B Midden	36.0	[99] 8.2 (40.0)	[70] 0.2 (1.0)	12.1 (59.0)	493	2	20.5
Subtotal, Midden	116.0	[99] 10.8 (23.7)	[134] 0.8 (1.8)	33.9 (75.5)	790	5	45.5
Total, 22It563	134.0	32.9 (40.5)	[159] 1.8 (2.2)	46.5 (57.3)	1,691	19	81.2
Grand Totals							
Features	6,741.8	[181] 2,100.65 (85.2)	[96] 52.9 (2.1)	261.65 (10.6)	3,086	50.9	2,466.2
Midden	1,549.0	183.9 (20.0)	[185] 1.4 (0.5)	77.7 (29.5)	808		263.0
Total	8,290.8	[181] 2,284.55 (83.7)	[281] 54.2 (2.0)	339.55 (12.4)	3,894	50.9	2,729.2

Samples from the three prepared areas from the Middle Archaic components contained the following material: Feature 6 contained (96.6%) hickory nutshell fragments, an acorn husk fragment, and wood fragments. Feature 73, in addition to hickory nutshell (99.9%) and wood fragments (0.1%), contained one pokeweed seed and a single hackberry seed. Feature 120 contained the widest range of material in addition to the 99.6% hickory nutshells, including walnut fragments, fern spores, a persimmon seed, unidentifiable seed fragments, and wood fragments.

Samples from the remaining features contained almost exclusively hickory nutshell fragments (86.2-99.9%) and wood fragments. However, a few seeds or seed fragments were identified, including grass, fern, and persimmon, along with one acorn husk.

The features contained more charred plant remains per unit volume (0.001-4.0% weight/volume) than the midden samples (<1.0% weight/volume). Plant remains were concentrated in refuse pits and areas of burning.

THE POPLAR SITE (22It576)

The Poplar site, a 1 m (3.3 ft) high mound (Figure 4) was located in the floodplain of the Tombigbee River and occupied from the Early Archaic through the Mississippian stage. Plant remains from 713 liters of soil samples from 14 features, four burials, and eleven midden samples were analyzed (Appendix II: Table 2). A complete column of midden in Block D was analyzed with one sample from every 20 cm (7.9 in). In other blocks, only one midden sample was analyzed.

The midden samples spanned Early Archaic (Kirk) through the Woodland occupations of this site. Of the 506.0 grams of floral remains, 91.7% are hickory nutshells. Acorn husks were present in every level in Block D and the sample from Block A, but were not in the samples from Blocks B and C. Wood remains were also present in each sample analyzed and usually were pine, hardwood, or resin. In one sample from the Sykes-White Springs/Benton zone possible cane fragments were also identified. These charred plant fragments show continuity throughout the occupation in proportion and kinds of plant remains. The only seeds in the midden samples were fern spores. Most (96.4%) were concentrated in Early Archaic midden samples (Levels 12 and 16), and the others were scattered in the Benton and Woodland midden samples. The Middle Archaic Sykes-White Springs/Benton exhibited the greatest density in this and all other samples examined in this project. In one two-liter sample, there was 26 grams of floral material. This zone was also characterized by a dark cultural midden, which contained concentrations of charred plant remains 6,300% greater than previous level! The charred floral material amounted to 13% weight to volume in this occupation.

The features contained most of the floral remains analyzed (84.4%: 427.7 g), and included one Middle Archaic pit, three Middle Archaic Sykes-White Springs pits, one Middle Archaic Sykes-White Springs hearth, a Gulf Formational hearth, one Middle Archaic (Sykes-White Springs/Benton) prepared area, one Middle Archaic Eva pit, five Early Archaic pits, one unaffiliated pit, one Middle Archaic Eva burial; and three Middle Archaic, probable Benton burials.

The charred plant remains in the features were dominated by hickory nutshells with an average of 91.8% per features ranging from only 1.1% in a Gulf Formational hearth (Feature 5) to 97.4% in Burial 11 (Benton). The most abundant floral material was in the large Middle Archaic (Sykes-White Springs/Benton) prepared area in Block D (Feature 49) which contained 146.1

grams of plant material. This was dominated by hickory nutshells (96.1%), but it also contained five seeds.

Middle Archaic pits were the feature type containing the next most frequent amount of floral remains. One of these pits (Feature 98) contained only (85.4%) hickory nutshell, well below the average amount. Feature 85, containing the most floral remains in pits also contained two small fragments of cane (Arundinaria). Another Middle Archaic pit, Feature 71, also contained one yellow star grass (Hypoxis hirsuta) and one pokewood seed along with two indeterminate seeds and 15 fern spores. The one probable Early Archaic pit (Feature 111) contained almost 40 grams of floral remains, including (93.5%) hickory nutshells, but it also contained acorn husks and hardwood fragments. Feature 5, the Gulf Formational hearth, had curcurbit rind, unidentifiable seeds, and fruit remains in addition to hickory nutshell and wood. The high amount of oak (6.8 g) in this feature suggests its probable use as firewood.

The fill of four Middle Archaic burials was examined (3, 4, 11, and 14) for botanical remains. Burial 11 contained by far the most floral remains (75.5 g), but is also had 20-30 times the volume of fill. All contained hickory nutshell (63.8-97.4%), fragments of acorn and wood; and Burial 11 also contained fruit remains (pericarp or fruit skin).

The macrobotanical analysis indicated that the Sykes-White Springs/Benton midden component had the highest concentration of hickory nutshells of any midden sample at any project site. A three-season occupation of the Sykes-White Springs/Benton can be hypothesized from the presence of hickory and acorn (fall) and fruits (spring and summer). Winter use is difficult to document from any site, because preservable seasonal indicators are lacking. The large number of seeds were predominately in the midden samples and consisted primarily of fern spores. However other types of seeds and fruit fragments were contained in the features.

THE ILEX SITE (22It590)

The Ilex site was located in the floodplain adjacent to Mackey's Creek. The site matrix was fluvial and contained evidence of occupation from the Early Archaic through the Mississippian stages.

The samples from this site consisted of seven cultural features and seven from a midden control column in Block A-Z. The control column samples all consisted of four liters of soil, while feature volumes were variable. Study of macrobotanical remains produced limited results (Appendix II: Table 3).

Not surprisingly, identified floral remains were dominated by carbonized hickory nutshells and acorn fragments. Carbonized seeds were recovered from the feature samples, but virtually all the specimens were unidentifiable. The presence of hickory nutshells and acorns in these samples is consistent with the findings from other sites. The weights of the identified nutshell samples from the control column generally are small (ca. 0.5-4.9 g) and preclude discussion of possible differences between cultural components. The higher weights (nutshells) recorded in the feature samples can be accounted for by the generally larger volumes of these samples. The presence of relatively large quantities of nutshells in these features may reflect use of this material as fuel.

THE HICKORY SITE (22It621)

The Hickory site was a low mound rising 50-60 cm (1.6-2.0 ft) above the floodplain of the Tombigbee River (Figure 15). It was located in a low and very wet area, only ca. 200 m (656 ft) from the valley wall and Site 22It563. The site had been occupied from at least the Early Archaic (Kirk) through the Late Woodland periods.

The focus of the investigations at this site was the Early Archaic component, and botanical materials from 1,482 liters of soil from three features and 27 midden samples were analyzed in this study (Appendix II: Table 4). The midden samples were large volumes of soil ranging from 2-68 liters with an average of 43 liters and were taken at 5 cm (2 in) intervals in the control block in Block D. The increased volume number of samples studied and the closeness of sampling reflects both the focus on the Early Archaic and the integrity of the deposits at this site.

Unfortunately, in all the midden samples studies, a total of only 7.3 grams of floral material was present, although 11 samples were only partially analyzed. The presence of floral material while low (averaging only 0.2 grams per sample), it was very consistent, and no sample was devoid of material.

In the midden samples, hickory nutshells were not the most frequent floral remains (42.5%). Wood remains were the most frequent (56.2%) floral type with only a few acorn husks, six fern spores, and ten unidentifiable seed fragments. The floral material was most abundant in the upper 30 cm (11.8 in) of the Early Archaic deposit.

All features analyzed from the Hickory site were pits, however, only one (Feature 4) could be affiliated with the Early Archaic component. The other two pits (Features 3 and 6) could not be associated with any specific component. In the features, hickory nutshell comprises an average of 90.7% while acorn shell and wood comprise 0.7% and 7.8%, respectively. Five fern spores and one indeterminate seed were also recovered from the features. It should be noted, however, that the percentage of hickory nutshell from the Hickory site is lower than from the other sites studied. Overall, the concentration of plant remains from the Hickory site ranges from 0.00009-0.08% weight/volume (Appendix II: Table 5). In an effort to obtain more floral samples, sediments from the enlarged control block units (1x1 m: 3.3x3.3 ft), except four liters of samples to be preserved in perpetuity, were processed. However, this did not yield proportionately more botanical remains. The paucity of plant remains may have resulted from soil and floodplain location, which may have accelerated the rate of organic decomposition. Alternatively, short occupations and/or the function of the site may account for the paucity of plant materials. This scarcity obviates any postulation concerning seasonality or the prehistoric vegetation at the site.

THE BEECH AND OAK SITES (22It623 and 22It624)

The Beech and Oak sites were located on two adjacent fragments of an abandoned floodplain levee of the Tombigbee River (Figure 17). Although the sites have separate numbers, they are considered as one for analytical purposes. This locality was occupied from the Early Archaic through the Late Woodland periods. The focus of the investigations at these sites was on the Late Archaic component, for in all other sites investigated it had been disturbed. In addition, this was one of the few floodplain sites investigated that was not a midden mound with the dark organically stained midden zone. This site had only a moderately dark midden zone with easily detected features.

A total of 413.6 grams of floral material from 3,588 liters of soil was identified from the Beech and Oak sites (Appendix II: Table 6). Plant remains are dominated by carbonized hickory nutshell. Other minority plant remains include carbonized acorn nutshell, ring-porous hardwood, pine, grape, fern spores, pokeweed, unidentifiable seeds, and hardwoods.

The midden samples were obtained from Block A of each site intermittently from the surface to the base of excavations and were a standard four liters each. The amount of floral remains in the midden samples was quite low (40.4 g) and they usually were dominated by wood material (75.2%), with hickory nutshells amounting to 24.3%, and acorn to 0.5%. The majority of the wood (93.4%) came from one sample only 20 cm (7.9 in) below the surface at the Oak site, and it is not representative of the middens. With this exception, the average floral material was low (1.1 g) per sample. Two seeds were recovered, one pokeweed and one fern spore, both from the Beech site.

Of the nine features from which floral remains were examined three were well-defined Late Archaic pits (Features 9, 11, and 14) and one was a pit of unknown cultural affiliation from the Beech site (22It623). Five features were studied from the Oak site (22It624): one Late Archaic pit (Feature 1), a Middle Archaic (Benton) compound pit (Feature 7), a mixed Late Archaic and Mississippian pit (Feature 9), and one pit of unknown affiliation (Feature 4).

A total of 373.2 grams of floral remains were identified from these nine features. This represents 90.2% of the floral material from both sites and indicates the concentration of plant material in features in general as opposed to the midden. Over half the feature floral material, however, came from the Benton compound pit (Feature 7 at the Oak site). Samples of 16 strata within this pit were analyzed, and all but one were documented by charred hickory nutshells at an average density of 93%. Acorn husks were present in six strata (5.4%), and wood fragments, although low in frequency, (1.7%) were present in all but one. The samples from this feature also contained a grape seed, four fern spores, and two unidentifiable seed fragments. The four Late Archaic pits contained a total of 73.9 grams of plant remains, but most (75.8%) were in two pits (Feature 14 at the Beech site and Feature 1 at the Oak site). All of these features were dominated by hickory nutshells (96.5%), with traces of acorn husk in three pits, and small amounts of wood in all. One pit at the Oak site (Feature 1) had a possible geranium (Geranium carolinianum) seed. The other pits followed the same pattern of plant material, except the mixed Late Archaic/Mississippian pit at the Oak site (Feature 9) had 618 fern spores in it - far more than any other feature and 97.2% of all recovered from the samples. A grape seed was also identified in a pit of unknown cultural affiliation (Feature 2) at the Beech site.

The relative densities of floral remains varied from 0.08-0.004%, except in Feature 2 at 22It623 (0.3%) and Level 2 at 22It624 (0.5%) (Appendix II: Table 7). The concentrations from the Walnut, Poplar, Ilex, and Aralia samples varied from 0.001% to greater than 4% for feature fills and was less than 1% for general levels (Sheldon 1981). These differences may be attributable to a number of factors, including site function, duration of occupation, season of occupation, and soil type.

An inference can be made on the vegetation at the Late Archaic Beech and Oak sites based upon the identified wood fragments and the abundant fern spores. The sites were probably covered with a mixed hardwood forest with heavy canopy, low herbaceous undergrowth, and probably few clearings.

SITE 22It606

Site 22It606 was located on a Pleistocene terrace remnant overlooking the Tombigbee floodplain and was the only "upland" site investigated in this project. This site had been occupied from the Early Archaic through the Recent, however, the Late Woodland/Mississippian period deposits were intact, especially the features, and this was the focus of the investigations. A total of 293.2 grams of botanical material from six features was identified from this site (Appendix II: Table 8). Since midden samples lacked integrity, they were not analyzed.

Samples from six pit features were analyzed from this site: four Late Woodland/Mississippian (Features 18, 19, 20, and 45), one Middle Archaic Sykes-White Springs (Feature 28), and one mixed Late Archaic, Woodland, and Historic (Feature 30). A total of 293.2 grams of carbonized plant material was identified from 1,167 liters of soil and was composed of 41.7% wood fragments, 30% hickory nutshells, 10.9% acorn husks, and 17.4% unidentified material, along with 537 seeds.

Most of the material (78.7%) was in two Late Woodland/Mississippian pits (Features 18 and 20). With only one exception, all plants identified are wild, whether from Archaic, Woodland, or Mississippian features. Most (41.7%) of the sample is wood, both pine and hardwood, and hickory pericarp. There are some acorn pericarp fragments and a variety of seeds of grasses, weedy plants, and a few fruits, including persimmon. Miscellaneous specimens include fern spores, possible fruit skin fragments, pericarps, exines, pine resin, acorn fragments, and unidentified seeds of various shapes, The one domesticated plant is represented by four maize (Zea mays) cupules in Feature 20.

The low amount of hickory in the Late Woodland/Mississippian pits is different from other components. The average amount of hickory nutshells is 21.5% with a range of 1.6-44.6%. The one Middle Archaic pit (Feature 28) contained 96.3% hickory nutshells, which agrees well with other Archaic samples. The high amount of wood charcoal (average 27.3%, range 0.3-62.4%) is also unusual and only found associated with this component.

There were several unidentified seeds of various sizes and shapes in these features. One was an unusual ellipsoid seed with a protruding point of attachment and a low ridge on one side. These seeds were obtained from two Late Woodland/Mississippian pits (Features 45 and 19) and the mixed pit (Feature 30).

Relative densities of different important floral types and different distributions in dated features provide some subsistence information at this site (Appendix II: Table 9). All peoples occupying the site were utilizing (or at least depositing) the same types of wild plants. Two Late Woodland/Mississippian pits (Feature 45, C-14 date A.D. 1,090, and Feature 18 C-14 date A.D. 1,270-1,350) produced 20-60% hickory nutshells and 1-7% acorn shells. Feature 20, however, which dated to A.D. 1,220 and yielded the maize, produced an average of 8% hickory nutshell and from 2-58% acorn, with more acorn in the youngest strata.

THE ARALIA SITE (22It563)

The Aralia site was situated at the eastern edge of the Tombigbee floodplain and at the base of the steep valley wall. The major occupation at this site was during the Henson Springs phase of the Late Gulf Formational stage radiocarbon dated at about 460 B.C.

The 81.2 grams of floral material identified from 134 liters of soil were primarily from two major features (Features 10 and 11: 35.7 g and 45.5 g) and midden in each of the two major excavation blocks (A and B). The 27 midden samples were taken at 10 cm (3.9 in) intervals throughout the profile. More volume of midden (116 liters) was analyzed than for the feature, which probably accounts for the fact that the majority of specimens (56%) recovered were from the midden (Appendix II: Table 10).

While a relatively diverse sample of floral remains was recovered, the interpretation of these materials is clouded somewhat by the identification of modern contaminants (predominantly uncarbonized specimens) in various contexts within the site. Although it is unlikely that carbonized plant remains in this sample have been contaminated through the inclusion of recently carbonized specimens floating in the air, this remains a possibility that will require further study.

The plant remains from both the features and midden were similar. Most (57.3%) of the identified material is charred wood; hickory nutshells account for 40.5% and acorns account for 2.2% of the total.

The plant remains from the Aralia site contained more carbonized seeds (1,691) than any other site. Identifiable seeds include pokeweed, chenopods (Chenopodium sp.), persimmon, and grape, however, most seeds were unidentifiable. A single wild bean species fragment, apparently of recent origin, was recovered. Oak, pine, and unidentified hardwoods made up the wood samples.

This sample from the Gulf Formational stage is also different from the Archaic samples in the low percentage of hickory and high percentages of wood, acorn, and weeds. Since these materials are in good context, the comparisons with other sites is more significant.

SUMMARY OF MACROBOTANICAL INFORMATION

A total of 2,727.4 grams of macrobotanical remains and 3,894 seeds from eight sites were identified during this project. The range of species identified was relatively narrow, probably as a result of poor preservation in acidic soils, coupled with differential preservation of porous and dense plant parts.

The plant materials were preserved through charring, which effectively slowed the rate of decomposition in these acidic environments. However, the process of charring plants was probably selective, depending in part on cultural preference in methods of food preparation, choice of firewood, and modes of deposition. In addition, post-depositional factors such as pit digging and refilling also affect the location of plant remains. Therefore, the sample of charred plant remains recovered from any site represents a relatively small portion of the total plant resources once utilized by the site occupants (Wing and Brown 1979:147). The charring of seeds, hickory and acorn parts from these sites may have occurred during processing, through secondary use as a fuel (nutshell), or accidental chatting in a forest fire after deposition. Roasting nuts or parching seeds to facilitate storage is well-documented ethnographically and may account for their condition and preservation (Smith 1978:109; Yarnell 1964).

Irrespective of the preservation problems, the archaeologically recovered plant remains revealed much information and patterns which were not available by any other means, and the data are internally comparable. As Tables 91 and 92 indicate, 90.3% of the plant remains were recovered from feature context and 9.6% from the midden samples. This is likely related to the fact that 81.3% of the soil volume came from features, and only 19.7% came from midden. The density ratio, however, indicates that more plant remains were contained in midden soil (6 grams per liter) than in the feature fill (3 grams per liter). This result was unexpected, but it probably reflects the larger volume of feature fill that was processed.

When viewed at the site level, the samples from Walnut, Hickory, Ilex, Poplar, Oak and Beech were almost all from Middle or Late Archaic contexts. This sample amounted to 6,990.1 liters of soil and produced 2,353 grams of plant remains, and 1,666 seeds or fern spores. This sample is from the best possible context at these sites and indicates a strong pattern of hickory nutshell dominance (98.4-83.8%) followed by minor amounts of wood and acorn nutshell with a ratio of 90:9:1. Seed patterns appear to be site specific.

Indication of seasonality of the occupations represented in the plant remains are generally restricted to summer and fall. Nuts and acorns were generally harvested during October and November (Hudson 1976; Swanton 1946). This is clouded, however, by the probability that these archaeological samples reflect both collection efforts occurring during occupation of the site and long-term storage and transport. Evidence documents that there is a fall-bias of plant assemblages collected from archaeological deposits. The under-representation of winter-spring occupations must be anticipated, along with the absence of many plant resources that are usually not preserved in archaeological deposits (leaves, small fruits, roots, and fungi). Therefore, while nuts and seeds were important food resources during prehistory, their role in the whole economy must be interpreted with caution.

The ubiquity of hickory nutshell in the Archaic period sites and the strong presence at the later sites suggests its importance in the subsistence base. The nuts mature in October and November. They were sometimes eaten raw by the Indians, but more commonly the oil, known as "hickory milk" (Bartram 1928:57; Hudson 1976:301), was extracted. The nuts were pounded, and the cracked pieces were put into a pot of boiling water. Afterward, the shells sank to the bottom, and the liquid was passed through a fine strainer which preserved the seasoning (for hominy and corn cakes). Bartram reported seeing more than 100 bushels of hickory nuts stored for one family (Bartram 1928:57).

Some patterns of usage can be seen in the plant remains identified with respect to second-line foods like acorns and seeds. Amounts of acorn husks appears to fluctuate and peaks during the Benton and Mississippian periods. Although small quantities of acorn were recovered, this is probably due to its secondary use and/or its fragile shells. Consequently, Chapman (1975) has suggested that the weight of acorn must be multiplied by ten in order to compare it directly to the denser hickory nutshell. If the weights are multiplied by this factor, acorns represent 8.0% of Early Archaic remains; 10.5% of Middle Archaic; 31% of Benton; 25.2% of Late Archaic; 7.5% of Gulf Formational; 21.5% of Late Woodland-Mississippian; and 88.7% of Late Mississippian. This likely reflects a more realistic proportion of this food source through time. Acorns ripen throughout the fall; Indians preferred the sweet, white oak group fruits (especially Q. virginiana), but they usually extracted oil from all the species (Hudson 1976; Swanton 1946).

Only small quantities of walnut (Juglans nigra) were recovered from cultural contexts. This is probably due to the fact that walnut trees were widely dispersed in the natural forests.

Although 3,894 seeds and fern spores were recovered, many were unidentifiable. Only 40 identifiable seeds were found in 2.7 kg of carbonized plant material. They appeared, however, to occur more frequently in later time periods. In the Late Archaic an average of one seed was found in each 146 grams. During the Gulf Formational the concentration increases to one seed per 37 grams. Many of these seeds identified are opportunistic species common to forest clearings and edges of paths.

The presence of so many fern spores in the midden samples from Early Archaic through Late Archaic components probably reflects the primary forest environment. A similar habitat is present today at floodplain elevations in mature secondary forests. The canopy is closed, effectively shutting out direct sunlight, eliminating understory shrubs and herbaceous plants and encouraging the growth of ferns and other shade-tolerant vegetation.

Small quantities of cane culm fragments were recovered from Middle and Late Archaic features. Cane grows along riverbanks and in swamps, often forming canebrakes. Its culms are available throughout the year. Seeds were sometimes used as food, but most commonly its culms were utilized as raw material for baskets, mats, arrows, fish traps, and backing for wattle walls, among many other things (Hudson 1976:287; Swanton 1846:244). Wood was found in every sample that was sorted. Pine, other gymnosperms, oak, other ring-porous species, sweet gum, and other diffuse-porous species are represented. Most pieces could not be identified further because of their small size.

Analysis of plant remains from the Archaic period indicates that the subsistence base of the people was partially dependent upon gathered wild plants, especially hickory nutshell. The increase in quantities of nutshell and concentrations of charred remains in the Sykes-White Springs/Benton component midden coincides with other evidence that the use of the midden mounds was intense during that time. The large number of features, the presence of structures or at least activity centers, hearths, burials, and numbers of artifacts also point towards long-term use of the sites as base camps for several residential groups.

Gulf Formational plant remains from the Henson Springs component at 22It563 indicate an economic reliance on gathered foodstuffs dominated by nuts and seeds. The identified plant resources occur in the Tombigbee bottoms even today and presumably could have been obtained with little difficulty throughout most of prehistory. It is possible to infer a subsistence base dependent on the scheduling of *gathering-hunting-fishing* activities. This proposed economy is comparable to subsistence strategies documented at a similar time depth in sites throughout much of this region and the southeastern United States (cf. Dye 1980; Morse 1967; Galm 1981). The origins of this pattern lie in the Archaic period, and it apparently continues with only minor changes until the widespread adoption of agriculture and an attendant shift in economic emphasis.

The botanical assemblage from the Late Woodland-Mississippian (A.D. 100-1,500), represented by 22It606, is clearly similar to previous assemblages. However, the large quantity of acorn suggests a widening of the food base. In combination with maize, large amounts of acorn are typical of Late Mississippian assemblages further down river where acorns represent a supplementary food source in areas of low fertility or years of decreased domesticated crop productivity. Settlement must have been repeated, intermittent, low-density, and short-term in nature. Perhaps agricultural groups spent brief periods at gathering/hunting stations supplementing their maize diet, or perhaps there was less emphasis upon intensive agriculture in this hinterland area.

In conclusion, the macrobotanical information, while hampered by poor preservation, has demonstrated that plant resources were remarkably similar through time and were present in sufficient quantity to preclude any major shifts in procurement strategy. This must have been an important factor in the cultural continuity documented in other facets of this study.

ANALYSIS OF BIOSILICATES FROM ARCHAEOLOGICAL SITES

As noted in the previous section, Botanical Analysis of Archaeological Material, the preservation methods of charred plant remains leaves a biased and incomplete record of the use of plants by the past occupants. In an attempt to recover other plant remains for a more representative sample to study, a biosilicated (phytolith) analysis was undertaken.

A phytolith is a deposit of opaline silica that forms in a plant cell and subsequently is deposited in underlying sediment upon death and decay of the plant. Phytoliths have many shapes and range in length from less than two microns to one millimeter. Plants are not represented by a simple phytolith, but rather by an assemblage of phytoliths (Moody 1972). The deposition of phytoliths for the most part is local, which enhances their value as indicators of subsistence paleobotanical communities, and potentially, paleoenvironments.

A test analysis was conducted, with a concentration on the Middle Archaic deposits, on samples from 22It539 and 22It576 to determine if biosilicates were present and if they could be identified from both feature and midden context. Ten samples from each site from features and midden were examined for opal phytoliths. Phytoliths were extracted using a modified version of the techniques first developed by Rovner (1971). Sediment samples were dried and successively treated in solutions of sodium hexametaphosphate and distilled water, HCL, and distilled water rinses, and floated to facilitate extraction in a solution of tetrabromoethane and absolute ethyl alcohol. Following extraction, samples were mounted on microscope slides and subjected to both scanning electron microscope (SEM) and Nomarski optical study for identification of phytoliths.

Phytoliths were present in all samples from 22It539 and 22It576 and are presented in Table 11 of Appendix II. Unfortunately, they could not be identified, and further analysis is required using modern plant species as a guide to the identification of plants from archaeological sediments. At present, a key for the identification of biosilicates of plant species from the southeastern United States does not exist. A more detailed analysis of samples derived from the Upper Tombigbee Valley, therefore, must await further study and the development of a specific plant key for this area.

It was logical to initiate the phytolith study, since the charred material recovered represents only a fraction of the plant material once present. As phytoliths are not subject to decay as pollen is, and are present in all plant parts, hence it was likely that they would be preserved in both midden and features. Phytoliths could, therefore, give a first view of the roots, tubers, leaves, fibers, and other currently "invisible" plant resources on dry sites that must have been used and have been documented at wet sites.

Although the abundance of phytoliths varies considerably among the samples, they contained sufficient phytoliths to warrant a detailed investigation using modern plants to develop an identification key. Paleoenvironmental and paleoagricultural reconstruction should be possible if comparable modern plant taxa can be utilized.

POLLEN ANALYSIS FROM ARCHAEOLOGICAL SITES

Sediment samples from four sites (22It539, 22It576, 22It590, and 22It621) were submitted for analysis during the course of this project. Initially, samples were sent from both midden and feature contexts from the first two sites excavated in Phase I, 22It539 (Walnut) and 22It576 (Poplar) to determine if the pollen was preserved in the typical midden mound context. As little or no pollen was preserved, it appeared that ordinary midden and feature context could not contain pollen, and general column sampling was discontinued. Later, during Phase I, additional samples from a likely micro-preservation environment beneath a large slab of sandstone from the Ilex (22It590) site were submitted with good results. Subsequently, in Phase III samples from the Hickory (22It621), the Walnut (22It539), and the Poplar (22It576) sites were submitted to cross-check the results from the Ilex site. In addition, perhaps more information on Early Archaic vegetation patterns could be gathered.

Samples (5 cc) were prepared using a standard concentration technique (modified from Mehringer 1967). Sediment samples were treated, successively, in KOH, HCI, HF, and acetolysis solution. Silicon fluid was used as the mounting medium in the preparation of slides. All slides were scanned at a magnification of 125 power in order to estimate pollen concentrations. Pollen identifications were conducted under magnifications of 500 and 125 power. All pollen and spores were tabulated, and, when possible, estimates of charcoal, fungus spores, fungal hyphae, "organic debris," and crystalline inclusions were provided. Additional sediment from samples submitted for analysis was retained for future reference.

Of the eight samples examined in Phase I, no pollen was identified in three of the samples examined, and pollen counts in the five remaining samples are relatively low and are not usable in a quantitative characterization of the vegetation assemblage. However, a qualitative assessment of the pollen identified in one of these samples produced rather surprising results. The pollen suite identified in the sample from the micro-preservation environment from 22It590 is indicative of a spruce-fir forest which includes birch, pine, hickory, beech, and oak. This would suggest a boreal-type forest coeval with late Early Archaic occupations at the Ilex site (Table 93). The identification of boreal pollen spectrum at this time depth (ca. 7,500-9,000 B.P.) is inconsistent with previously reported environmental syntheses from this region (Muto and Gunn 1985; Delcourt and Delcourt 1977).

TABLE 93
Results of Phase III pollen analysis.

Site	Provenience	Results
22It621	Early Archaic matrix	fine charcoal, fungal spores, birch (1)
	Pre-Early Archaic	fine charcoal, fungal spores and hyphae elm (1), oak (1), sugar maple (1)
22It576	Early Archaic matrix	fine charcoal, fungal spores and hyphae, no pollen
	Pre-Early Archaic	much fine charcoal, no pollen
22It539	Early Archaic matrix	fine charcoal, Rosaceae (2), pine (1)
	Pre-Early Archaic	fine charcoal, elm (2), oak (1)

Possible explanations of the Ilex pollen data may include the sampling of older redeposited sediments, or, possibly, the persistence of a relic stand of boreal forest on this Pleistocene outlier.

In Phase III, this explanation was tested. Samples of sediment from the Early Archaic deposits from the three other midden mounds containing this component were submitted for analysis. In addition, samples of sediment from each of the sites from beneath the Early Archaic material were submitted to determine the vegetation pattern.

No boreal pollen was present in any of the other site samples, and only typical Early Holocene plants were identified. This leaves the boreal taxa from 22It590 as an anomaly, and suggests that a relic stand in a cold pocket existed there during the Early Holocene.

SUMMARY OF BOTANICAL STUDIES

Botanical studies were a major part of the research conducted during this project, and much information was produced from them that otherwise would not have been available. There were several aspects to these studies which included: 1) a quantification of the present vegetation on several sites under study as well as nearby areas; 2) research on the vegetational history of the mid-South during the late Pleistocene and Holocene; 3) identification and analysis of charred plant remains from archaeological context of the eight sites which were intensively excavated; 4) phytolith identification and analysis of a sample of midden and feature soil; and 5) pollen analysis of systematic samples from profiles, specific micro-preservation environments, and specific midden/profile samples.

The studies of present and past vegetation in and around the study area have provided a perspective which complements that provided by the geomorphological research presented in the previous chapter. Essentially, the late Pleistocene vegetation was characteristic of a colder environment than today with a dissected terrain and a forest cover dominated by boreal coniferous trees but also containing some deciduous species. By ca. 5,000 B.P. the climate had warmed sufficiently so that the boreal coniferous trees had migrated north out of the mid-South, and the forests were dominated by pine. By ca. 2,500-2,000 B.P. sweet gum and tupelo became major parts of the forest, and pine had increased continuously. The wetlands continues to contain a deciduous forest, unlike the uplands. The present-day vegetation of pine forest uplands and deciduous wetlands was in place, therefore, ca. 4,000-4,500 years ago.

The pollen studies conducted in this project, while generally unproductive in cultural terms, did add new information to this vegetation scenario. The pollen from the Ilex site (22It539) in Early Archaic (ca. 9,000-10,000 B.P.) context confirms the presence of boreal trees (spruce/fir) in the site area at a time later than that projected by a specialist in this field. It appears that the Ilex site was and still is in a cold pocket of Mackey's Creek and supported a relict stand of cooler-loving trees. Similar islands of boreal species exist elsewhere in the region. For example, at "Natural Bridge" in northwest Alabama, ca. 20 mi (32 km) east of Fulton, Ms a relict stand of hemlock still exists today in a cool, moist enclosed depression formed by underground and surface streams.

The study of plant remains from archaeological context comprised the bulk of the botanical work. A large volume of soil (8,290.8 liters) was floated, cleaned, and the plant material hand-picked for botanical studies. Samples from 47 features and 12 excavation blocks produced 2,727.4 g of charred plant fragments and 3,894 charred seeds and fern spores. The analysis of the kind, distribution, and density produced interesting results. One major discovery was identification of a possible Archaic "botanical signature" of 89:10:1 (hickory:wood:acorn) in both midden and features. This pattern changes during the Gulf Formational and Late Woodland to 29:64:7 and appears to reflect more use of second-line resources, probably due to population increase. The use of fruits also appears to increase in the post-Archaic deposits.

The seasonal occupation for most sites was spring through fall, although winter was hard to document. The common problem of food storage and biases preservation plague the time-of-occupation issue.

Another aspect of the information available from the archaeobotanical data was the "intensity" of site occupation. The amount or density of plant material in the midden samples was unevenly distributed during the Archaic periods. There was a definite peak in the amount present during the Middle Archaic Sykes-White Springs/Benton period. In all sites examined, increases of up to 6,300% were documented during this time. It is hypothesized that this represents a longer term use by more people. These data correlate well with other indicators of increased site use during this period.

Site floral environments were also reflected in the charred seeds and fern spores in the samples. While most samples from all time periods reflected a closed forest canopy, the post-Archaic deposits had many more seeds from disturbed habitats, perhaps reflecting more use of the sites, old field vegetation, and more clearing within site areas.

The experiment with phytolith analysis was both interesting and frustrating. The phytoliths were abundantly present in all contexts examined and likely are from roots, tubers, fabric, cordage, other plant products and foods which have decayed beyond common recognition. The absence of an appropriate identification key, at this time, precludes the identification of the plants which produced the phytoliths.

CHAPTER VIII LITHIC ANALYSIS

The most abundant material recovered from the eleven sites discussed in this report are stone tools and the by-products of their manufacture. While this an enormous amount of material, most (ca. 60%) were recovered from mixed context. Although lithic assemblages were recovered from Early Archaic through the Mississippian periods, only those from the Archaic were represented by both midden and feature material and in good context. A sample of these Archaic assemblages were the focus of Phase III lithic analysis. Since distinct Archaic components were superimposed at several sites, and components from the same time periods were found at several sites, both diachronic and synchronic variation in lithic manufacture and use could be studied. Heat treatment, replication, and functional studies were implemented to develop an understanding of the manufacture and use of stone tools and to develop the variable schemes that were applied to archaeological specimens. Both macroscopic and microscopic techniques were used to investigate the assemblages. This chapter describes the lithic study in detail.

The first section presents the theoretical perspectives, appropriate background, and research questions involved in the lithic study. Descriptive and analytical questions based on the preliminary assessment of lithic assemblages are posed; likely explanations for changes in technology are explored; and expectations for the composition of lithic assemblages are specified. The second section deals with sampling techniques and general laboratory procedures of this large data set which affect the interpretation of these assemblages. The third section describes the experimental program and includes the results of heat treatment, replication, and use-wear experiments. The fourth section presents the variables selected for analysis of over 6,000 chipped stone tools included in the analysis. These variables were selected to answer the research questions posed and reflect the results of the experimental work as well. The fifth section presents the results of the analysis and addresses the specific questions posed in section one.

SECTION 1: THEORETICAL PERSPECTIVE AND RESEARCH QUESTIONS

Since the recognition and acceptance of ceraunia "thunderbolts of Zeus," as ancient, man-made tools, relatively indestructible stone artifacts have provided abundant evidence of past lifeways. Traditionally, stone tool types have been used to describe and compare cultures, and to establish chronologies. These goals assume that the combinations of morphological characteristics used to define tool types reflect ideas about how an ideal tool should be made. Since shared ideas are the essence of culture, the greater the resemblance of tool types between assemblages, the closer the cultural affinities. Changes in tool types are usually ascribed to direct or indirect diffusion of ideas between groups, or to developments in group stylistic preference through time. Using this approach, material objects can contribute to the description and history of cultural similarities and differences. The initial examination of midden mound lithics was, in part, designed and implemented with this traditional approach as a model.

Although description is a necessary first step in artifact analysis, it can not provide a framework for explaining why similarities and differences should exist among archaeological assemblages. Alternatively, a systems approach which articulates material objects, human behavior, and environment can provide ways to explore functional relationships among archaeological remains and can provide a structure for testing causal hypotheses. If archaeological remains are viewed as the results and reflections of behavior, relevant artifact dimensions linking material items and behavior must be identified and made explicit (Binford 1972; Schiffer 1976). Connections between material objects and behavior are often expressed as schema for lithic "life cycles" including procurement of raw materials, steps in manufacture, use, maintenance, recycling, and discard (Collins 1975; Schiffer 1976; House 1974). These models predict the products of manufacture at different points in the cycle and their entry into the archaeological record. On another level, one can relate artifact variables to cultural subsystems (Knudson 1973): attributes of production, utilization, and style can be used to elucidate economic (in the sense of systematic provisioning), social, and ideological behavior. Our aim in the Phase III lithic analysis was to use a systems approach to explore possible changes in lithic technology during the Archaic in the Upper Tombigbee Valley. To accomplish this, lithic technology must be seen as only one aspect of a subsistence/settlement system. It is the interrelationship of environment, both physical and social, and technology that produces lithic assemblages.

LITHIC TECHNOLOGY

Data collected during the initial two phases of the midden mound project raised other questions which needed to be addressed in the examination of lithic technology in the Upper Tombigbee Valley. The questions involve both descriptive and analytical levels of investigation. These data may be discussed under three aspects of lithic technology: style, manufacture, and use, although they are all obviously interrelated.

STYLISTIC VARIATION

Bifacial tools modified for hafting are usually the most refined, patterned tools found at Archaic sites. Whole tool shape in plan view and cross-section, haft configurations, and pressure flaking patterns are usually thought to express time-sensitive stylistic information. The traditional southeastern projectile point/knife typologies (Cambron and Hulse 1975; Ensor 1982; Futato 1977, 1980) were used in the first two phases of this project and allowed the identification of archaeological components to broad sequential cultural periods. The specimens in the stylistic type categories, though, showed considerable variation. Classification difficulties are due to many factors - the polythetic nature of type definitions (Thomas 1971; Johnson 1981), the plethora of names given to objects with very similar characteristics, the level of familiarity of laboratory personnel with regional typologies, the frequent occurrence of resharpening and reworking of tool parts, and the incomplete nature of most archaeological specimens. Therefore, one aspect of the Phase III analysis was a limited exploration of ways in which to make the classification of hafted bifaces and investigation of the correspondence of specific types with stratigraphic sequences more objective. Four continuous variables (haft length, neck width, base width, and haft angle) and three discrete variables (haft type, base configuration, and haft treatment) were recorded for the hafting elements of bifaces during Phase III, and statistical techniques were used to evaluate types and show their relationship to time periods (Davis et al. 1982; Johnson 1981). Concurrent examination of the manufacturing sequences and the function (or functions) of these hafted bifaces were made to determine if differences among types are indeed stylistic.

MANUFACTURING VARIATION

Possible changes in lithic technology had been identified in the preliminary analysis from the information produced on lithic raw material, heat treatment, and identification of stages of biface manufacture. Basically, the lithic assemblages at all the midden mound sites appear to be the product of bifacial reduction. There are relatively few formal unifacial tools, and utilized flakes are often bifacial reduction flakes - the character of these biface assemblages differs through time and from site to site. Variation is most obvious in types of hafted bifaces; however, specific types require different manufacturing strategies, cores, preforms and debitage are all potential sources of information about the character of the finished tool assemblage. The midden mound experimental program was designed, in part, to document the manufacturing strategies for different biface types and to help relate the products of manufacturing processes to the behaviors that produced them.

The primary materials used for lithic manufacture throughout the Archaic were the locally available cobbles derived from the Tuscaloosa gravels (Camden, Yellow Chert, and Pickwick cherts). During the latter part of the Middle Archaic imported blue-gray Fort Payne chert became the prominent raw material for tool manufacture. The presence of cache blades, most likely tool blanks, made from Fort Payne chert and the lack of large pieces of Fort Payne debitage indicate that initial stages of production using this material took place away from the midden mound sites. Before addressing questions about why Fort Payne chert should appear in the Tombigbee Valley or by what mechanism it was brought into the valley, it was necessary to document how much of this material is actually present at sites at different time periods, how its frequency varied from site to site, and what kinds of artifacts are made from this material.

Phase I and II analysis showed that approximately 90% of the chert used for tool manufacture at these sites have been exposed to heat. Exposure to heat may have been intentional (heat treatment), unintentional (heat alteration), or both. It was important to know to what extent and at what point in the manufacturing sequence both intentional and unintentional heating occurred, and if these processes occurred to the same extent for all cherts at all sites and during all time periods.

FUNCTIONAL VARIATION

Although several of the morphological categories used during Phase I and II imply function, i.e., scraper, knife, drill; no use-wear studies were conducted, and no attempt was made to record specifically functional variables. Yet knowledge of tool function or functions is critical to the understanding of tool manufacture, final tool morphology, tool curation or disposal, and finally site use. Are different tool types used for different tasks? Are tools special purpose or resharpening and reuse rather than manufacture? Are tools expediently or intensively used? Were sites used for the same range of activities at all time periods? To understand stylistic or manufacturing variation, it is necessary to be able to control for tool function.

ARCHAIC SUBSISTENCE/SETTLEMENT PATTERN

Explanations for changes in technology are only possible within the context of a subsistence settlement system. Analysis of features, geomorphological and floral data, and paleoenvironmental reconstruction, as well as other archaeological studies of the Archaic in the Upper Tombigbee Valley, provided the framework for the lithic study. Several possible scenarios or hypotheses were suggested in earlier chapters to explain the changing lifeways during the Archaic and for the function of the sites during this period. Given the information available at the time of the study, the following factors appeared most influential in affecting the nature of midden mound lithic assemblages; i.e. resource availability, contact with outside cultures, geomorphic development of the valley, and changes in mobility strategies. These will be discussed in order of presumed importance - from the least compelling to the most.

Throughout the Archaic period, the Tombigbee Valley was probably a food-rich area with a wide variety of plants and animals available seasonally. Although faunal remains from the midden mounds are poorly preserved, the floral remains shows consistent use of hickory nuts, acorns, and seeds throughout the Archaic. Environmental studies in the lower Illinois River Valley (Asch, Ford and Asch 1972) and the Duck River Basin (Klippel 1982), as well as the Tombigbee Valley (Muto and Gunn 1981), indicate that river valleys may have been less effected by the fluctuations of the Holocene climate, and there is also no reason to suspect that any one location in the research area would be better for procuring subsistence resources than another. For the present, it is assumed that all subsistence activities could have been performed at any of the floodplain sites and at all time periods investigated.

Stone tool manufacture is obviously dependent on the types, quality, and abundance of lithic raw materials available. In the Upper Tombigbee Valley several sources of local raw materials for tool manufacture were, and still are, available. First, chert cobbles (Camden, Yellow Chert, and Pickwick), ferruginous sandstone, and conglomerate derived from the Tuscaloosa formation were available in the river valley from gravel bars deposited during the late Pleistocene. One such buried gravel bar adjacent to the Ilex site (22It590) was documented, and it is possible that the other sites were located near gravel bars which are now buried, although there is no direct evidence for this supposition. Today, floodplain gravel bars in the UTV and major tributaries are covered by alluvial deposits and are not exposed even in the main channel. They were probably buried during the Early Archaic, a period of rapid deposition on the floodplain. On the other hand, the buried gravel bars may have been exposed periodically by shifting river or stream channels throughout the Archaic.

In addition to main valley sources, chert cobbles and other materials are available in the floodplains of tributary streams. One such source is 22It1026, a gravel deposit along Rock Creek 8 km (5 mi) north of the study area. Gravel deposits are also available in the uplands. Pickwick and Camden cobbles are major components of modern gravel quarries near Beldon, Ms, 30 km (19 mi) northeast of the study area. Here cobbles in a range of sizes and quality are found near the present-day surface. Both Camden and Pickwick cobbles used in the Phase III experimental program were gathered fortuitously along the valley margins near Fulton, Ms. Although valley floor gravel bars may have been gradually buried, other sources of the most common stone used for artifacts were available in the upland gravel sources which lie between the sites and the nearest blue-gray Fort Payne chert source area. It is, therefore, unlikely that Fort Payne chert was brought into the valley solely as a substitute for dwindling local chert supplies.

Increase in Fort Payne chert and the dominance of Benton hafted bifaces in the sites investigated during the latter part of the Middle Archaic indicates increased contact with areas outside the Upper Tombigbee Valley. Contact may have been in the form of population movement between the Tombigbee and Middle Tennessee valleys and/or trade in goods and ideas. The reasons for increased social interaction at this time are not readily apparent, although it is tempting to suggest movement of populations from the intervening uplands during the Hypsithermal.

As the Upper Tombigbee Valley attained its modern configuration, potential habitation sites in the floodplain may have decreased. Alluviation would have decreased valley floor relief, and fewer high spots immune from seasonal flooding may have existed. Numerous small, buried Archaic sites in low lying areas of the modern floodplain have been identified. Many of these appear to be Early Archaic, single component sites (Bense 1983). Floodplain landforms, such as point and parallel bars and levees which continued to increase in elevation above the general valley floor, would have been prime areas for occupation and may have been used more frequently and for longer periods of time in the later part of the Archaic. The consequences of more intensive site occupation are discussed below in conjunction with changes in mobility strategies.

In recent years mobility strategies, schemes for moving human groups to resources or vice versa, have been a major focus of hunter/gatherer studies (Binford 1979, 1980; Carlson 1979; Kelly 1983). Studies of Archaic settlement patterns in the lower Illinois River Valley (Brown and Vierra 1983) and the Duck River Valley (Amick 1984) indicate a shift from residential mobility in which small groups of producers and consumers move as a unit through a seasonal round to logistic mobility in which consumers remain at a more permanent base camp for several seasons, while small groups procure distant resources and bring them back to consumers. Generally, residential mobility is an effective strategy when a variety of overlapping resource zones can be freely exploited by small groups of hunter/gatherers, while logistic mobility is more advantageous when "a single resource determines site location as a result of abundance or necessity," (Carlson 1979:118) or when competition induces a group to concentrate its subsistence efforts in one locality (Vierra 1982:170).

In the Upper Tombigbee Valley as in the lower Illinois River Valley, the shift from one strategy to the other may have occurred as the result of a resource "push" or "pull." A reduction in resource availability during the Hypsithermal climatic episode may have pushed the population from the surrounding uplands into the main river valley. The early Holocene (Early Archaic) subsistence/settlement system undoubtedly encompassed sites in the main valley, secondary streams, and uplands. The warming and drying effects of the mid-Holocene Hypsithermal need only to have made resources in the uplands relatively less abundant to effect group movement through the seasonal round. Populations may have utilized valley resources for longer periods of time during their seasonal round.

Although the Tombigbee Valley may have been a food-rich area throughout the Archaic, a change in the river regime may have increased productivity. The shift in the river system from braided channels to a single, deep channel with natural levees and backwater lakes, created and replenished by flooding, may have increased the abundance of fish and waterfowl in the valley, particularly during the Spring when plant and other animal resources are relatively scarce. The abundance of aquatic resources amenable to storage may have created a resource "pull" providing the incentive for more permanent habitations (Brown and Vierra 1979, 1983).

According to Carlson (1979) a residential mobility pattern is composed of a series of residential camps. Residential camps are occupied by "a single band or by a microband for the purpose of exploiting resources in the vicinity." They will be occupied for only a short period of time, perhaps less than one season. Logistic mobility patterns (Carlson discusses three such patterns) are composed of base camps, residential, and/or extraction camps. Base camps may be occupied by more than one band or a macroband. They will be located near an abundant resource and occupied as long as that resource is available, i.e., occupation is apt to be at least seasonal. Extraction camps are limited activity, short-term camps occupied by producers only.

Archaeologically, residential camps are best distinguished from base camps by different distributions of debitage classes and by varieties of feature types. The partitioning of activity space in base camps will be greater than in residential camps. Evidence of more substantial housing may be found at base camps, especially if they are occupied during winter. Storage and garbage pits are also characteristic of base camps. Since both maintenance and subsistence tasks will be performed at both kinds of camps, a functionally similar set of tools may be found, especially if a residential camp is reoccupied several times at different seasons. Variety of tool types distinguishes residential and base camps from limited activity extraction camps.

Preliminary analysis of midden mound artifacts and features indicate that earlier occupations (Early Archaic through Eva/Morrow Mountain period components) at all sites were residential camps. A wide variety of tools are present in the assemblages from these occupations, but features are limited. During the Sykes-White Springs and Benton periods, and perhaps later as well, occupations were more likely base camps. At three sites (22It539, 22It576, and 22It590), prepared area features may represent structures, or at least specialized work areas. Hearths were present as well as a variety of pit features. Therefore, it was at least plausible to consider the effects of changing mobility strategies on the composition of tool assemblages.

RELATIONSHIP BETWEEN MOBILITY STRATEGIES AND LITHIC ASSEMBLAGES

Archaeologists interested in using adaptive or evolutionary frameworks to discuss past behavior have become increasingly aware of the limitations of traditional stone tool typologies. Recently, an economic perspective has been applied to lithic analysis (cf. Lurie 1982, n.d.). This perspective considers the costs and benefits of choices made by prehistoric people in the manufacture and use of stone tools. The variables used to discuss these costs and benefits are independent of morphological categories. The following discussion identifies the factors that determine costs and benefits and the behaviors that are likely responses to these factors.

Three interrelated sets of factors determine the costs and benefits accrued from stone tool technology: 1) the nature of the resources exploited by a population, 2) the availability of suitable raw materials and reduction strategies for tool manufacture, and 3) the degree of group mobility. The nature of resources exploited determines the need for efficiency (the ratio of input to output) in procurement. Technology may be beneficial, since it can improve efficiency by reducing input in terms of energy, time and risk, or by increasing output (Torrence 1983; Jochim 1982; Joslin-Jeske 1981, 1982; Earle and Christenson 1980). The suitability of raw materials for tools and methods of tool manufacture are also related to the kind of items procured or processed, but obtaining these raw materials and applying various reduction strategies represents major costs of technology. Hunter/gatherer mobility impinges on both these factors. Ethnographic accounts document a range of mobility patterns, from daily or weekly movement to fully sedentary (Lee and DeVore 1968; Bicchieri 1971; Carlson 1979), but for hueristic purposes, the effects of high versus low mobility will be considered.

A high degree of mobility affects stone technology in several ways. It imposes a 'carrying cost' (Shott 1983:3). Although nonhuman means of transportation (Binford 1979) and caching large items at sites in anticipation of return (Gould 1978) can cut these costs, aspects of tool manufacture and use are often more important. Assemblages may be composed of small, easily carried tools (Torrence 1983), expedient tools discarded immediately after use, or multipurpose tools such as large bifaces which can serve as combination knives, saws, piercers and choppers, as well as sources of small sharp flakes (Binford 1978). High mobility may restrict the time that can be invested in tool manufacture. Needs can be filled by minimally modified chipped stone tools rather than those requiring hours of work, such as shaped ground stone tools (Boydston n.d.). High mobility can have a positive effect on the procurement of raw materials for tool manufacture. An adequate range of materials may be obtained at low cost if access to resources is not restricted and procurement is embedded within other activities performed throughout a group's territory (Goodyear 1979; Binford 1979).

Low mobility poses other problems. Sedentary groups may experience resource depletion within their immediate living areas or face restricted access to necessary goods. As population grows in absolute numbers or aggregates, a mobile life style becomes difficult. It becomes harder to move consumers to resources. Both larger population and longer occupations at any one location place stress on available resources. As subsistence resources become inadequate to meet population demands, new items may be incorporated into the diet. For example, during the late Middle Archaic in Illinois a second line resource - small seeds - were added to the diet, although their procurement and processing required more time and effort than collecting and processing a first line staple - nuts (Asch, Ford and Asch 1972). Additions to the diet often require the introduction of new tools or the use of old tools in new ways. New grinding tools and new cooking vessels may have been necessary to prepare seeds, or tools used to grind pigments may have been adapted for grinding seed.

Another response to subsistence resource stress is the introduction of more efficient ways to procure old food items. Efficiency is often accomplished by producing more specific or more complex tools. Specificity refers to the diversity of tools within a functional class (Torrence 1983). The more specific a tool is to its task, the greater the chance of success in completing the task. Torrence points out that specificity is high in situations where resource options are limited and the risk of failure is high. It is not surprising that Eskimos have different harpoons for different highly mobile aquatic animals. Tool complexity refers to the number of "configurationally distinct items" that make up a tool or facility (Oswalt 1973:31). The greater the number of items, the more complex the tool. According to Shott (1983) complexity may increase tool specificity or versatility. While specificity may reduce the risk of failure, versatility may reduce the time necessary to make tools. Alternate parts can make a tool suitable for several types of tasks with little advance preparation, and broken or used elements such as stone projectile points or scrapers can be replaced without the creation of a totally new tool. The cost of an efficient tool kit is in more careful, time-consuming, and more scheduled tool manufacture.

Stress on resources need not be restricted to food items. Other materials, such as wood for housing, fire, or tools, and lithic raw materials can be depleted. As a location is used for longer periods of time, better quality stone may become scarce, and knappers resort to using inferior material or altering the stone to improve its quality. Thermal alteration of chert is one such response. Rick (1978:53-54) discusses the costs and benefits of heating. The costs include procurement of chert amenable to alteration, building a facility, collecting fuel, and risking failure. The benefits are chert that can be knapped with greater predictability and tools with sharper edges. Alternatively, good quality raw materials can be obtained through special trips or trade, again at a cost of time and energy. In either case, more expensive material for tool manufacture should be used more economically. It will be used to make special tools, perhaps smaller tools, to be knapped with less waste and to be used more intensively (Joslin-Jeske 1982).

As population aggregates, access to resources often becomes controlled or restricted creating stresses similar to those mentioned above. In addition, larger populations are usually more socially complex than smaller ones. Greater complexity requires more information transfer both within and between groups (Wobst 1977; Weissner 1983). Information encoded in tools can take on the function of status markers or group identifiers. Among hunter-gatherers this information is likely to be in the form of exotic materials for manufacture, stylistic variation in tool form, and elements of tool decoration. In other words, greater effort is expended in tool manufacture. Clearly a more sedentary lifestyle places demands on technology that require increased investment of time and energy in tool manufacture and economies in tool use.

The preceding discussion makes it possible to develop expectations for what lithic assemblages would look like in residential and base camps. These models deal first with raw material acquisition and use, then tool manufacture, and finally tool use.

RAW MATERIAL ACQUISITION AND USE

Chert cobbles, the primary material for tool manufacture, would have been available in a range of sizes and quality. The costs involved in procuring these materials is low. Nonlocal raw materials such as Fort Payne and Bangor cherts and Tallahatta quartzite are also used for tool manufacture, but may or may not have a higher cost. If groups are highly mobile, and small quantities of these materials occur in a component, we suspect that the nonlocal material were acquired incidental to some other activity, i.e. the procurement of that raw material was not systematic. In this situation the cost of nonlocal raw material would be low. If mobility is low, and if nonlocal raw materials are acquired in large quantities, the costs would be higher whether the material was acquired by special activity groups or trade.

Although chert resources are plentiful, cobbles do vary considerably in quality and size. When mobility is high and group size small, the chances of depleting supplies of larger and better quality raw material are small. Since good quality materials are cheap and plentiful, we would expect that all varieties of tools, from utilized flakes to refined bifaces, would be made from good quality material. When mobility is low, sources of raw material in the immediate area of a site may be "picked over." The larger cobbles and cobbles of the highest quality material would be used first. As length of occupation increases only smaller cobbles and cobbles of lesser quality would be available. In this situation, available good quality material would be used for more highly shaped tools, while lesser quality raw materials would be used for more expediently produced tools. Alternatively, good quality material may be brought in from farther away, or heat treatment may be used to improve the quality of chert. Both of these alternatives have associated costs. Again, since these two sources of good material are more costly, we would expect that they would be used more economically, i.e. for tools that require more shaping.

We assume that prehistoric knappers were well acquainted with the materials available to them and techniques of thermal alteration, and that they made conscious choices about which materials were suitable for tool manufacture and use. Expectations for the acquisition and use of raw materials at residential camp sites (high mobility) and base camp sites (low mobility) can be summarized as follows:

In residential camps associated with high mobility

a. local raw material used for tools will be of good quality, since the supply is plentiful. Poor quality raw material can be rejected without penalty. The chances of exhausting the supply of good raw material is minimal, since the length of occupation is short.

b. Good quality local raw material will be used for all types of tools and there is little restriction on the size of tools that can be made.

c. Since good quality material is plentiful, heat treatment may not be necessary.

d. Small quantities of a wide variety of nonlocal cherts may be found in the assemblage, probably in the form of finished tools.

In base camps associated with low mobility

a. Local raw material exhaustion becomes more likely. Therefore, we would expect more fair or poor quality raw materials to be used for tool manufacture.

b. Good quality material is at a premium. It may be used selectively for those tools that require greater refinement. Tools on the whole may be smaller, since large cobbles may become scarce.

c. Heat treatment should be more pervasive as the supply of good quality raw material dwindles.

d. Nonlocal material may be required to manufacture more refined tools and for larger tools that can not be made from local raw materials.

TOOL MANUFACTURING CHOICES

Degree of mobility influences the use of resources in the immediate area of a site. When mobility is high and small groups are moving, or have the ability to move, across the landscape frequently, the need for efficient resource procurement is low. Therefore, tool kits need not be efficient. Tools can be expediently made. Less energy will be invested in their manufacture. But a highly mobile group does need a tool kit that is portable. As mobility decreases, stress on local resources increases. A more efficient tool kit increases the success in procuring these resources. Efficiency is gained through greater tool complexity and standardization. Tool complexity is difficult to measure archaeologically, since most tool parts are not preserved, but one indication of tool complexity is hafting. The stone portions of hafted tools may be more standardized to facilitate easy replacement of parts. This is particularly true of the haft section of the stone element. Preforms for hafted tools may also be more standardized. Greater specialization in tool form may also increase the effectiveness with which a task is done. More specialized tools are likely to have a single function. Since mobility is reduced there is no penalty in having a variety of tools on hand for specific jobs.

Expectations for tool manufacture at residential camp sites (high mobility) and base camp sites (low mobility) can be summarized as follows:

In residential camps associated with high mobility

a. Tool manufacture will be more expedient. Utilized and edge retouched flakes will make up a higher percentage of the tool assemblage. Debitage will represent early stages of tool manufacture.

b. Tools will be less complex. Tools of the same morphological type will not be standardized. Hafted tools will not be at a premium, and their haft portions will not be highly standardized.

c. We would expect to find more multipurpose tools, both because there is little need for specificity and because they are more portable.

In base camps associated with low mobility

a. More energy will be invested in tool manufacture. We would expect to find more extensively shaped tools, both chipped and ground stone, and less utilized or simply retouched pieces in the assemblages.

b. We would expect that tools become more specialized, since tools designed for one task are more efficient at that task, and portability is less important. There will be fewer multipurpose tools, unless multipurpose tools themselves fill a particular technological slot, i.e. tools to take on logistical forays, or tools made out of expensive raw materials that have to be used economically.

c. Tools will be more complex. Tools will be more standardized, and there will be more hafted tools.

TOOL USE STRATEGIES

Tool use strategies can also reflect an increasingly sedentary population. If tools need not be efficient, and if the time and energy invested in manufacture is low, then tools will be used expediently. Tools used for a task may be abandoned when the task is completed, since others can be made quickly if the need arises. If tools break, they will most likely be abandoned. Casually made and used tools need not be part of the hunter-gatherer's baggage as he or she moves on to the next camp. Because camps are used for a relatively short period of time, we may recover more whole tools that still seem useful. There will be fewer chances for abandoned tools to be trampled or accidentally kicked into a fire.

Conversely, if resources are scarce and require more efficient tools that take more time and energy to manufacture, then these tools will be more heavily used, resharpened, and curated. They will be reworked, or perhaps simply used for the same or another purpose when broken. As length of occupation increases and opportunities for trampling and cleanup activities increase, the number of broken tools should increase. These broken pieces may also be smaller than than those found in a short-term occupation. Expectations for tool use at residential camp sites and base camp sites can be summarized as follows:

In residential camps associated with high mobility
a. Tools will show comparatively little use.
b. Tools will not be resharpened or reworked when broken as often in residential camp occupations as in base camp occupations.
c. Abandoned tools will be less broken and heat altered less often in residential camp occupations than in base camp occupations.

In base camps associated with low mobility
a. Tools will be used more intensively at in base camp occupations than at residential camps.
b. Tools will be resharpened and reworked more often in base camps than in residential camps.
c. Tools will be broken more often, the broken pieces will be smaller and more often heat altered in base camps than in residential camps.

SECTION 2: SAMPLE SELECTION AND GENERAL LABORATORY PROCEDURES

The first decision made for the Phase III lithic study was identification and selection of sample units which could be used to address research questions. Emphasis was placed on units with the highest integrity spanning the entire Archaic periods. Units selected had good stratigraphic definition, included chronologically diagnostic materials, and/or were radiocarbon dated. Units were then grouped into six time categories based on these diagnostic materials and radiocarbon dates. The time categories were:

1	Early Archaic	(Dalton/Greenbriar/Kirk points)
2	Middle Archaic 1	(Eva/Morrow Mountain points)
3	Middle Archaic 2	(Eva/Morrow Mountain and Sykes/White Springs points)
4	Middle Archaic 3	(Sykes-White Springs and Benton points)
5	Middle Archaic 4	(Benton points)
6	Late Archaic	(Little Bear Creek points)

Sample units were selected from six sites (22It539, 22It576, 22It590, 22It621, 22It623, and 22It624) (Table 94). They vary in size, content, and time periods represented. These variations are due to specific site histories and functions as well as preservation and excavation strategies. A total of 6,391 chipped and ground stone tools were included in the lithic study. The Walnut site (22It539) contained material from five of the six time periods. The only period not represented was the Late Archaic. This site provided the best sample of Sykes/White Springs and Benton period occupations and contributed the majority of chipped stone artifacts in the lithic study (total number from midden and features = 2,375). While the samples were smaller from the Poplar (22It576: n=1,409), Ilex (22It590: n=970), and Hickory (22It621: n=648) sites, they were particularly important because of the well-documented Early Archaic and early Middle Archaic assemblages. The Beech and Oak sites (22It623 and 22It624) provided the only Late Archaic assemblage, although the sample was small (n=332 and n=558, respectively).

TABLE 94
Phase III midden and feature units.

Period	Unit	Description
22It539		
(1) Early Archaic	Block D Levels 18-21	6x8 m block
(2) Middle Archaic I	Block A Levels 15-17	4x4 m block
	Block D Levels 16-17	6x8 m block
	Block D Feature 128	Prepared area - 2.8x2.1x.73
	Block D Feature 131	Prepared area - 1.48x1.03..23
	Block D Feature 132	Prepared area - 1.31x1.49x.02
(4) Middle Archaic 3	Block A Levels 11-14	4x4 m block
(5) Middle Archaic 4	Block A Levels 5-10	4x4 m block
	Block B Levels 6-10	6x8 m block (20% sample taken)
	Block B Feature 6*	Prepared area - 1.78x3.34x.35
	Block C Feature 99*	Cache - 1.3x.16x.06
	Block C Feature 120	Prepared area - 5.08x6.39c.34
	Block D Feature 142	Pit - 1.33x1.38x.95
22It576		
(1) Early Archaic	Block D Levels 14-25	8x12 m block
	Block D Feature 115*	Pit - .68x.66x.39
	Block D Feature 116	Lithic concentration 1.10x1.06x.07
	Block D Feature 118	Lithic concentration 1.05x1.14x.11
	Block D Feature 119*	Lithic concentration .93x1.05x.06
	Block D Feature 120*	Lithic concentration .20x.61x.01
(2) Middle Archaic 1	Block D Levels 12-13	8x12 m block
	Block C Feature 90*	Pit - 1.81x1.94x.81
(3) Middle Archaic 2	Block D Levels 9-11	8x12 m block
(4) Middle Archaic 3	Block A Feature 71	Pit - 2.25x2.00x.27
(5) Middle Archaic 4	Block B Feature 10*	Cache - .26x.37x.05
	Block A Feature 49	Prepared area 2.65x2.65x.23
22It590		
(1) Early Archaic	Block W Levels 9-12*	4x4 m block
	Block Y Levels 9-12	4x4 m block
	Block E Levels 13-15	4x4 m block
	Block F Levels 10-14	4x4 m block
	Block J Levels 7-13*	2x2 m block
	TP 13 Levels 7-13	1x2 m block
(2) Middle Archaic 1	Block W Level 8*	4x4 m block
	Feature 6	Pit - .96x1.30x.88
(4) Middle Archaic 3	Block B Levels 6-10	
	Block J Feature 8*	Pit - 1.35x.39x1.22
(5) Middle Archaic 4	Block A Feature 34	Pit - .43x.70x.40
	Block B Feature 54*	Lithic cluster - .81x1.25x.11
	Block D Feature 73*	Pit - 1.20x1.18x.42

TABLE 94
Phase III midden and feature units (continued).

Period	Unit	Description
22It621		
(1) Early Archaic	Block A Levels 10-16*	4x4 m block
	Block C Levels 10.2-23	4x4 m block
	Feature 4	Pit .78 cm in diameter, .15 cm deep
(2) Middle Archaic 1	Block A Levels 6-9*	4x4 m block
	Block C Levels 6-10.1*	4x4 m block
	Block E Levels 8-10*	4x4 m block
	Feature 1	Lithic cluster - .36 in diameter
22It623		
(5) Middle Archaic 4	Block C Levels 6-9	4x4 m block
	Feature 14*	Compound pit - 1.55x1.95x.84
(6) Late Archaic	Block D levels 6-7	4x4 m block
	Feature 11*	Shallow pit - 1.17x1.35x?
	Feature 12*	Six ground stone tools
	Feature 20*	Cache
22It624		
(5) Middle Archaic 4	Block A Levels 8-9*	4x4 m block
	Feature 7*	Compound pit - 3.00x3.85x.75
(6) Late Archaic	Block A Levels 6-7*	4x4 m block
	Block B levels 6-8	4x4 m block
	Block C levels 6-8	4x4 m block
	Feature 15*	Pit - 1.20x1.23x.75

* Units represented by tools only.

A great deal of data were accumulated on lithic debitage during Phase I and II. Data include information on raw material and size grade (1 inch or 2.54 cm, 1/2 inch or 1.3 cm, and 1/4 inch or .64 cm), and counts, and weights within size grade (raw material groupings). An evaluation of this previously collected data from the selected units was undertaken, and a small number of units from each site was selected for additional study in response to research questions. These were selected based on the presence of large numbers of flakes and on the presence of sorted fine-screen samples from at least a portion of the unit. One hundred and fourteen debitage units from several blocks at each site and from all of the time categories were selected. Units were from the 2x2 m (6.6x6.6 ft) midden units or features. The fine-screen samples were usually taken from the control blocks (Appendix III: Table 1).

SAMPLE RETRIEVAL

Unfortunately there were unforeseen difficulties both in recovering actual specimens from storage and in recovering computerized data. These difficulties, to some extent, limited the range of analysis that could be performed. Although many of the problems encountered were remedied during Phase III, the time required to do so affected the time left for analysis.

The following discussion of these problems is designed to give an accurate account of the sample and to make recommendations for the processing and curation of materials from complex sites.

The most serious retrieval problem was the recovery of tools stored by artifact type and arbitrary type and arbitrary ID number, rather than by provenience. Since sample units were chosen by provenience, and there is no absolute relationship between ID number and provenience, the actual recovery of the designated artifacts from the hundreds of boxes and the thousands of bags and coin envelopes in which they were stored was a far greater problem than anticipated. Several smaller problems complicated the retrieval. The inclusion of utilized flakes with debitage necessitated searches through numerous debitage boxes and bags for specific ID numbers. Many artifacts selected for lithic analysis from 22It576 and 22It590 had been placed in a selected type collection to aid laboratory assistants in classifying artifacts during Phase I and II. These too were stored by artifact type rather than provenience, and specific ID numbers were difficult to find.

The method of sorting and storing debitage also posed difficulties. Lithic materials not considered tools had been sorted into flake size categories, (1 inch or 2.54 cm, 1/2 inch or 1.3 cm, and 1/4 inch or .64 cm), and several kinds of introduced rock categories, presumably unmodified lithic materials. Each flake size category was also divided by raw material types, and some raw material types were subdivided by the presence of heat treatment. Many levels of packaging had to be sorted and opened to retrieve the sample specimens.

Introduced rock was subdivided into 25 subgroups based primarily on raw material. One of these subgroups, non-utilized, fire-cracked chert/chunks, in fact contained any blocky or angular piece, heated or not, that was not called a core fragment or utilized chunk. Many of these pieces are the products of early stages of cobble reduction and are essential to the analysis of debitage. Even heat-altered pieces may show signs of intentional modification. None of these other 25 subdivisions were reexamined during Phase III.

Retrieval of information from computer files was also complicated by previously undetected errors in coding. During the course of the project, several individuals were in charge of setting up and retrieving computer data. None of these people were archaeologists actually engaged in collecting or analyzing data, and none of the archaeologists collecting data were thoroughly familiar with the data management system (SAS). Lack of continuity and communication between archaeologists and computer specialists made data retrieval much harder than necessary. In some cases, levels were incorrectly stored in the computer data. Therefore, when requests for identification numbers associated with selected sample units were requested, incorrect listings were generated. Although these problems were detected and corrected, much time was lost. The recovery rate of specimens averaged 90.8% with a range of 0-100%. Recovery rates for tools and debitage by unit by site are presented in Tables 2, 3 and 4 of Appendix III.

It should be noted that the artifacts or debitage not retrieved are still in midden mound storage boxes, but neither the time nor the personnel was available to search for them. The problem of recovery is not unique to this project; but similar difficulties plague large, complex archaeological projects (Lurie 1982). In light of the experience gained in the midden mound project, the following recommendations are made for storing items from multi-component sites containing thousands of artifacts and hundreds of thousands of pieces of debitage:

1. Store material by provenience. Major classes of materials, lithic, ceramics, floral, and faunal can be stored separately, but each should be stored by meaningful provenience units, not by arbitrary ID numbers or artifact types.
2. Lithic artifacts and debitage can be stored separately, since these are usually analyzed using different variables using different laboratory techniques as long as both are stored by provenience.
3. When planning the curation of specimens, consideration should be given to ease of recovery and reexamination. This is especially important when several stages of analysis are anticipated. Although coin envelopes are easy to write on and multiple staples ensure that specimens will not escape the storage facility, inspecting and retrieving their contents is very time consuming.
4. Computer work should be done if at all possible by archaeologists doing the analysis. Those intimately involved with recording and interpreting data are best able to pick out errors and inconsistencies in the data set. A great deal of time can be saved over the project as a whole when requests for computer-generated data do not have to go through intermediaries. Time should be budgeted at the beginning of any large project for familiarizing staff with the computer data management system in use and the general structure of the data sets.

LABORATORY PROCEDURES

As the retrieval of the selected artifacts from storage proceeded, items were repackaged in 3x5-inch plastic transparent envelopes. The original coin envelopes containing provenience information served as a backing for the artifact in its plastic bag. Artifacts were organized by provenience, and those examined during Phase III were separated from the main collection. This system of storage aids in cross-checking data sheets, identifying refitting fragments, and pulling specimens for special treatment, e.g. photographs.

Artifacts from each site were examined as a unit. All items were laid out by block and level on laboratory tables and examined for pieces that could be conjoined. Success varied according to site and time period. To increase consistency in recording variables, laboratory assistants were assigned particular categories of artifacts to evaluate. One recorded variables for all ground stone and for all small, broken tool fragments. The other recorded all utilized or potentially utilized flakes. Variables for all cores, preform, whole tools, including all hafted bifaces, were recorded by the lithic specialist. Frequent conferences were held among the laboratory staff to ensure that all personnel were aware of conventions used to record variables and to discuss any problems that might arise. Spot checks were made by the lithic specialist on coding sheets turned in by laboratory assistants. All computer data entries were checked for internal consistency and recording errors.

SECTION 3: EXPERIMENTAL PROGRAM

The lithic experimental program for the midden mound project addressed two primary aspects of lithic manufacture: heat treatment and tool reduction strategies. It also addressed tool function to a limited extent. Experimental work conducted in the Fall of 1984 provided several kinds of baseline information for those individuals who were to examine the sample of archaeological lithic material. Heat-treatment experiments were performed to produce examples of variation in color, luster, and workability for several kinds of chert heated to different temperatures. The examination of both unheated and heated materials not only identified the variables that were used to score heat treatment on the archaeological specimens, but it also identified those situations in which the assessment of heat treatment might prove difficult. The replication of several reduction sequences in the manufacture of Archaic tools (performed by flintknapper Jeffrey Kalin) supplied examples of tools at different stages of manufacture as well as samples of debitage for statistical analysis. This analysis of systematically collected debitage provided the framework for interpreting the hundreds of thousands of pieces of debris from the six sites. A set of use-wear experiments generated a comparative collection of tools with patterned edge modification from known and measured activities. These helped distinguish used and unused archaeological items, even when the motion with which the tool was used or the material on which it was used can only be assessed very generally. The details of the experimental program are described below.

HEAT TREATMENT

Since the work of Crabtree and Butler in 1964, controlled heat-treatment of chert has been recognized as an important technique in the manufacturing repertoire of prehistoric peoples. Presumably, chert was heated to improve knapping quality, although it may have been heated for aesthetic reasons as well. In general, heat treatment results in material with a more homogenous, vitreous matrix which flakes with less force and in a more predictable manner. Rick (1978) and Anderson (1979) suggest that heat treatment may have been used for technological reasons. Heat-treated cherts can be used to make larger, thinner tools and to produce tools with sharper edges. But there are costs involved in gaining these desirable qualities - costs associated with the process of heating, such as gathering fire wood and constructing a heat treatment facility, costs due to loss of stone during the heating process, and costs in tool use life, because heat-treated tools with sharp edges are not as long lasting as tools made from unheated materials.

Field and laboratory experiments have been performed to identify the critical temperatures and lengths of time needed to cause alteration in various lithic raw materials, and to define attributes that can be used to identify heat treatment in archaeological specimens (Purdy 1971,1974; Mandeville 1973; Mandeville and Flenniken 1974; Collins and Fenwick 1974; Gregg and Graybush 1976; Melcher and Zimmerman 1977; Weymouth and Mandeville 1975; Rick 1978). The visual criteria usually used to indicate heat treatment include changes in color, changes in luster, the presence of pronounced conchoidal rippling, and heat fracture scars of various sorts.

Color change is related to mineral impurities in the chert and may be very dramatic, but improvement in raw material quality can occur without color change, and color change can occur at temperatures below that needed to alter chert quality (Purdy 1974). In any case, it is necessary to have samples of unheated material with which to compare heated ones.

A better indicator of heating is differential luster on the exterior and interior of heated pieces. "On an artifact with flaked surfaces produced both before and after heating, a contrast will appear in the luster of the two surface types. Presence of such a luster contrast is near-certain evidence of heat treatment" (Rick 1978:57). If a heated piece has been subsequently flaked to the point that all of the preheated surface has been removed, the degree of luster may be used to indicate heat treatment, although with less certainty. Again, it is necessary to have numerous samples of unheated pieces of chert for comparison.

Identification of heat treatment formed an important part of the initial processing of chert tools and debitage in Phase I and II. At that time no attempt was made to distinguish intentional from unintentional heating. Experiments on heat treatment were undertaken in the Phase II lithic study to provide formal documentation of the changes that occur during the heat-treatment process, to identify those situations in which an evaluation of heat treatment is particularly difficult, and to distinguish between intentional and unintentional heating.

Preliminary heating experiments with Camden chert indicated that this chert exhibits change in color at 500° F (260.0° C) and that changes in luster occurred by 800° F (426.7° C). A more comprehensive set of heating episodes was then conducted. Four types of chert were used in these experiments: Camden (eight cobbles), Pickwick (five cobbles), blue-gray Fort Payne (20 flakes and chunks), and fossiliferous Fort Payne (eight samples). The samples chosen for the heat-treatment experiments were selected to represent the maximum variation for each type of raw material within the sample of raw materials collected in the study area during Phase I and II fieldwork. While only the darker variety of blue-gray Fort Payne was available, a wide variety of Camden, Pickwick and fossiliferous Fort Payne was available for the experiments. Several unheated chunks and flakes from each sample were retained to serve as baseline samples. A sample of each type of chert was heated in a kiln at 100° Fahrenheit intervals, beginning with 300° F (148.9° C) and ending at 1,000° F (537.8° C). Temperature was raised slowly, approximately 100° Fahrenheit per hour, until the desired temperature was reached. This temperature was maintained for one hour, and then the heat was turned off and the unopened kiln allowed to cool, usually overnight.

After each heating episode, specimens were examined for changes in color, luster, and workability. Color was recorded using the complete Munsell Color chart. Luster was recorded subjectively as dull, satin, semi-glossy, and glossy. Color and luster for both the unheated and heated specimens were recorded by a laboratory assistant. Changes in knappability were subjectively scored by the flintknapper. In general, unheated Camden and Pickwick chert were very hard to work; a great deal of energy was required to remove flakes from cobbles. After heating, the material was much easier to flake. The detailed results of these experiments are presented in Tables 5-7 in Appendix III. In addition to information collected during these controlled heat-treatment experiments, many informal observations were made on pieces of chert heated for use in replication experiments.

Well-defined changes in the color of Camden chert occurred at 500° F (260.0° C). At this temperature the color change, primarily from creams and yellows to pinks and reds, affected the outside of the heated specimen but often did not penetrate all the way into the interior. Archaeological specimens heated to this temperature may be difficult to identify as heat treated, depending on whether the inside, outside, or all parts of the cobble (preform or flake) is represented. As temperature is increased, the degree of color change became more pronounced, and penetration was complete. Complete color change usually occurred at 700° F (371.1° C). It should be noted, however, that completeness of color change was dependent on the thickness of the specimen as well as temperature. In no case was the pink or red color resulting from heat similar to unheated Camden with a naturally slight pinkish cast. At 800° F (426.7° C) definite luster change occurred in all but the most chalky specimen. Camden chert is fairly heat tolerant, but at 1,000° F some specimens became brittle and knapping quality declined. Below this temperature when heat fractures occurred, they were most often in thick flakes or bifaces that heated unevenly. These fractures also seemed to develop from small moisture-containing crystal pockets within the stone.

Pickwick chert changed in color and luster at the same temperatures and was equally heat tolerant. Pickwick chert often has concentric bands of dark gray, red, and yellow color. All of these changed in color and luster with heat. The gray and red colors became darker, while the yellow turned to red. The red color in unheated Pickwick was of a different hue than the red color in heated Camden chert. Problems in distinguishing heated Pickwick from heated Camden or other heated Tuscaloosa gravels arose when only one of the three Pickwick colors was present on an item. The heated red Pickwick is similar in color to heated Camden chert and may be similar to heated Yellow Chert. In addition, a small pieces of dark gray Pickwick material may be confused with the darker varieties of blue-gray Fort Payne chert.

Fossiliferous Fort Payne also responded well to heat. The gray material developed a strong pink to red cast at 400-500° F (204.4-260.0° C), and luster developed between 700° and 800° F. It is also a heat-tolerant chert. The experimental results are similar to those reported by Morrow for the Yellow Creek Archeological Project (1981).

In contrast, blue-gray Fort Payne chert from the Wilson Dam Tennessee Valley area was not heat tolerant. It became brittle and useless for knapping after heating to 500° F (260.0° C). Material heated to this temperature, or lower, often exhibited expansion fractures or breaks with very granular texture. At 800° F (426.7° C), all pieces shattered in the kiln. Resulting fragments were heavily crazed and covered with pot-lid fractures. It is unlikely that this material was intentionally heated prehistorically.

REPLICATION EXPERIMENTS

Preliminary classification of lithic artifacts in Phase I and II indicated that uses of raw materials and reduction strategies were not constant through time. To understand the lithic reduction strategies used prehistorically, replication sequences were outlined by S. A. Ahler, J. Kalin, and R. Lurie. Replication sequences were performed with the raw materials collected mainly from the study area (Camden and Pickwick cobbles collected near Fulton, Ms and blue-gray Fort Payne chert slabs collected from the Wilson Dam area). The products of the various reduction sequence stages included usable flakes, bifaces at different stages of completeness, and the debitage that results from each manufacturing step.

Five major manufacturing trajectories were outlined:

1 reduction of medium cobbles of Camden and Pickwick chert for the production of broad blade bifaces (Figure 38).
2 reduction of small cobbles of Camden and Pickwick chert for the production of narrow blade bifaces (Figure 39).
3 reduction of Fort Payne chert blanks to produce broad blade bifaces (Figure 40).
4 reduction of small and medium-sized cobbles for the production of usable flakes (Figure 40).
5 bipolar reduction of pebbles to produce flake and flake-like pieces that could be used as tools (Figure 40).

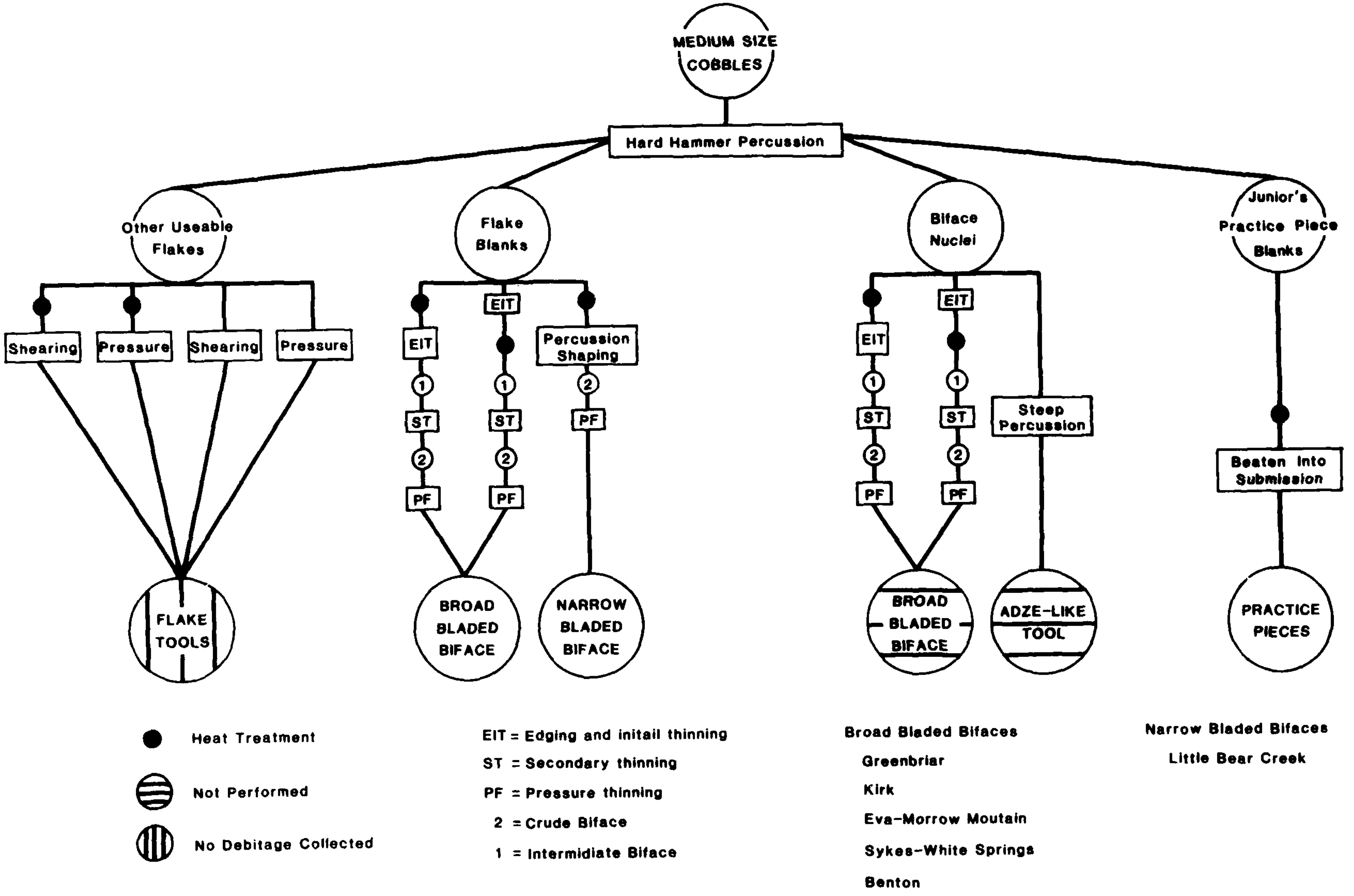


Figure 38

Model of medium-sized cobble reduction sequence

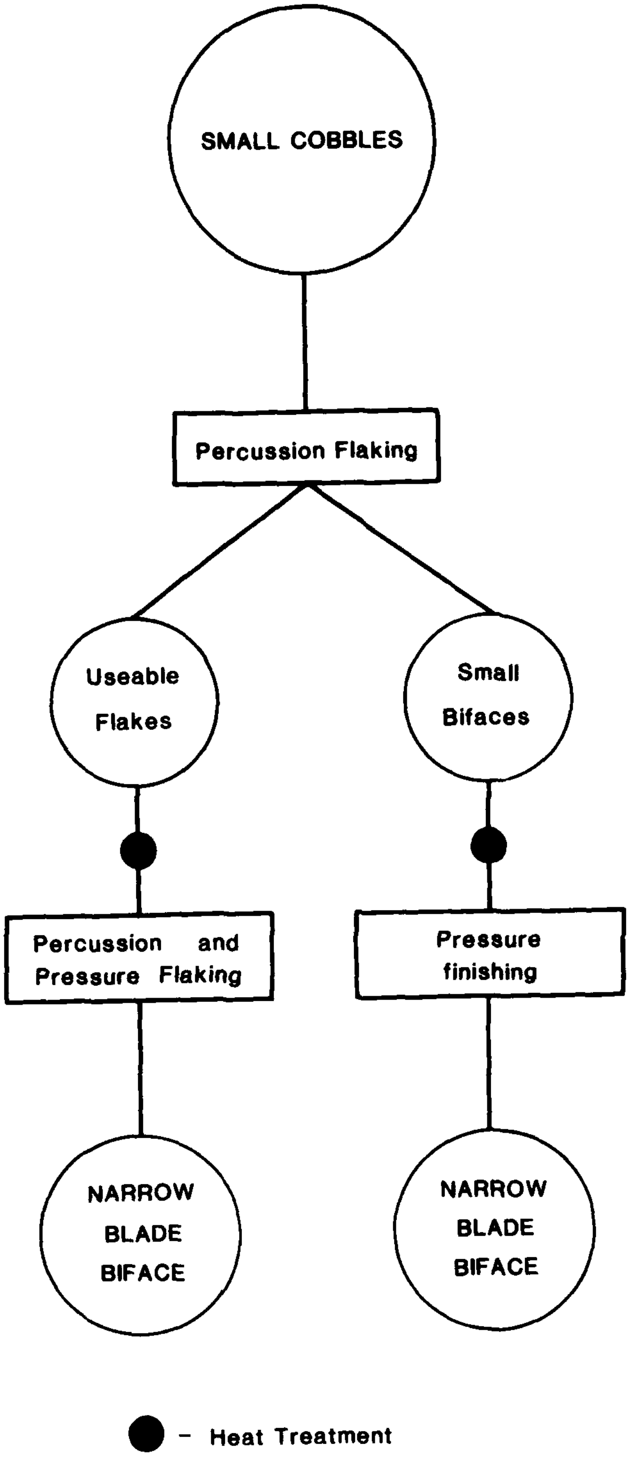


Figure 39

Model of small-sized cobble reduction sequence.

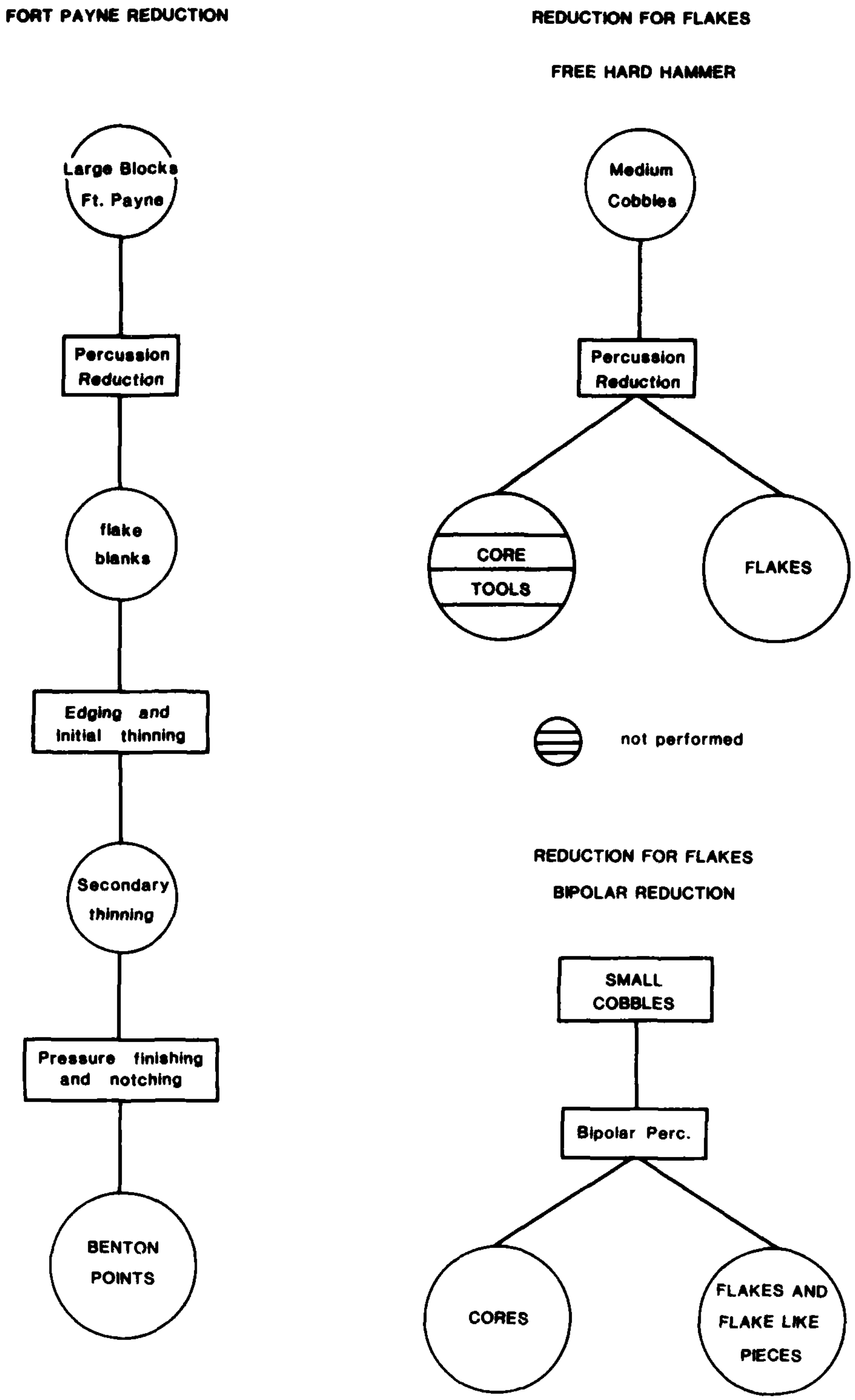


Figure 40
Model of Fort Payne reduction sequence, flake reduction sequence, and bipolar reduction sequence.

These sequences were established on the basis of the knapping and analytical experience of the lithic specialists, on archaeological literature, and from a preliminary examination of the recovered artifacts. The sequences were, therefore, specifically designed to contain the variability present in the archaeological assemblages to be studied.

The goal of the replication program was to produce at least ten examples of all five reduction sequences which would would include 10 examples of each intermediate stage of biface reduction, 10 examples of each hafted biface morphological type prominent in the Archaic assemblages, and at least 10 examples of debitage associated with each stage and type of reduction. This goal was not met in all cases because of limitations in time and availability of raw material. There were far more examples produced of early stages of biface manufacture than examples of finished items, because later stages of reduction were usually more time consuming (Tables 95 and 96). The production of Benton bifaces was also limited by the availability of suitable Fort Payne chert. Biface reduction consisted of four stages (whole cobble reduction, initial edging and thinning, secondary or advanced thinning, and biface trimming and finishing) so that intermediate products could be weighed and measured and debitage collected.

Table 95
Number of items produced in reduction experiments.

Type	Frequency
Cobbles reduced for flakes	
Free hard-hammer	12
Bipolar	12
Cobbles reduced for bifaces	77
Fort Payne blanks reduced for bifaces	10
Flake blanks and nuclei produced from medium cobbles	90
Small bifaces produced from small cobbles	16
Bifaces produced by edging and initial thinning	80
Bifaces produced by secondary thinning	37
Finished narrow bifaces	11
Finished broad blade bifaces	35

TABLE 96
Tools produced in the experimental program.

	Finished			Unfinished	Broken in manufacture		
Type	small	medium	large**	Whole*	EIT	ST***	Total
Greenbriar	2		4	1	2		9
Kirk	2	5	3				10
E/MM/CC	7	1			1		9
S-WS	1	3	1		2	3	9
Benton	1	2	1	3		2	9
LBC	8	5					13

E/MM/CC=Eva/Morrow Mountain/Cypress Creek S-WS=Sykes-White Springs
LBC=Little Bear Creek

* Whole unfinished pieces have been manufactured through the secondary thinning stage.

** The size of the finished produced in most cases is dependent on the size of the flake blank or nucleus used for manufacture.
EIT = Items broken during edging and initial thinning.

*** ST = Items broken during secondary thinning.

The following procedures for collecting and recording information were used on each knapping episode performed in the experimental program. All cobbles and Fort Payne flake blanks were assigned numbers, measured, and weighed before reduction. Cobbles used for bipolar reduction and free-hand hard hammer reduction for flake production were not heated. All Camden and Pickwick materials used to produce bifaces were heated in an early part of the reduction sequence. All knapping episodes were performed on large plastic sheets to facilitate the collection of debitage. The time taken for each stage of reduction, the type of percussor used, and comments by the knapper were recorded for all steps in biface reduction. Each stage of reduction was photographed. A mirror was placed behind the tool is that plan view and cross-section would appear the same. The reduction sequences are described in order of complexity.

1. Bipolar Reduction - Because no raw materials of the correct size had been collected from the project area, 12 small Jasper cobbles fortuitously collected along the embankment of the Mississippi River in New Orleans, La were used and reduced using a bipolar technique. In some cases, the cobbles were wrapped in a piece of leather to facilitate holding when placed on a sandstone anvil. The cobble was then struck with a hammerstone repeatedly until it was reduced to flakes and flake-like pieces.

2. Reduction of cobbles for flakes - Cobbles of various sizes were reduced by free hard hammer percussion to produce flakes suitable for making a variety of small tools. Four replicators were involved in this part of the experimental program, and the flake size, shape, and thickness varied with the abilities of the knappers. Each knapper was asked to select those flakes that they thought would be useful for tools. These were collected separately from the other debris.

3. Small Cobble Reduction - Using a medium-sized hammerstone, several small cobbles were reduced into roughly shaped small bifaces and flake blanks which were heated and used to produce narrow bladed bifaces similar to Little Bear Creek points found in the Late Archaic period assemblages. In most cases, the production of these bifaces was accomplished in two or three stages rather than in the four stages used for the production of broad blades. Cobble reduction and initial edging and thinning were combined into one step to produce the small rough bifaces. Flake blanks were reduced through initial edging and thinning. No secondary thinning was performed in the manufacture of these tools. Bifaces were finished using a combination of percussion, with a small hammerstone, and pressure flaking, with antler tine pressure flaker. Serrations were added on some of the tools using the narrow condyle of a deer mandible.

According to the replicator, the manufacture of these points involves little more than striking off excess material from a suitable flake or biface nucleus using a non-marginal flaking technique until a digital biface, almost as thick as it was wide, was obtained (Kalin personal communication 1981). The cortical platform of the flake blank often served as the base of the tool. Occasional traces of cortex or flake blank surfaces were sometimes present. Short, curved, thick-platformed flakes with simple dorsal scarring made up the majority of the percussion flakes produced. Some more advanced flakes with smaller platforms and complex dorsal surfaces could also be produced. The intersection of opposing dorsal scars on advanced flakes seldom exceeded 1-1.5 cm (.4-.6 in) from the flake's platform. Pressure flake finishing could be used to smooth the previous surface imperfections. When thin flake blanks were the starting point for these narrow-bladed points, the percussion stage could be skipped all together and all further work done solely by pressure. The stem may be finished using either percussion or pressure.

These tools were easy to produce. They used a minimal amount of raw material and took little time to manufacture (7-12 minutes). Because of their width/thickness ratio (approximately 2.5/1), they are sturdy tools that seldom break during manufacture or use.

4. Medium Cobble Reduction - Camden and Pickwick cobbles were reduced to produce all but one of the major types of broad-bladed points found in the Archaic assemblages of the midden mound sites: Greenbriar, Kirk, Eva/Morrow Mountain, and Sykes-White Springs. The manufacture of these point types usually involved the following steps.
   a). The raw cobbles were reduced by free hand hammer percussion into nuclei (crude bifaces), cores, flake blanks of a size suitable for bifacial reduction, other usable flakes, "practice pieces" (blocky pieces without much potential for bifacial reduction), and non-usable debitage.
   b). Nuclei and flake blanks were then selected for biface production and were heated. In some cases edging and initial thinning were performed before heating. After heat treatment edging and initial thinning, secondary thinning, and finishing were performed. Flaking styles differed in order to replicate the particular type of point being made.

The production of Eva/Morrow Mountain points involved greater flaking complexity than the production of narrow-bladed Little Bear Creek type points described above. The plano-convex or biconvex bifacial Eva/Morrow Mountain points were replicated using a small hammerstone. They were manufactured with minimal shearing platform preparation, and like narrow-bladed stem points, they were manufactured with a minimum amount of flaking. The technique of shearing platform preparation without platform grinding was chosen because it produced flake scar attributes most like those found on the archaeological specimens. This technique provided the proper angle for marginal thinning. The lack of platform grinding was responsible for hinge fractures, and/or step fractures similar to those seen on archaeological pieces. Debitage often exhibited crushed platforms.

Unlike the Little Bear Creek points, pressure flaking was kept to a minimum and used primarily for margin leveling. Eva/Morrow Mountains were reduced as triangular bifaces, and the flake debitage produced included basal flakes which intersect lateral thinning flakes and leave right angle flake scars on some of the flake dorsal surfaces. When a minimal amount of flaking was used to produce Eva/Morrow Mountains, the resulting debitage did not exceed an intermediate complexity in flake dorsal scarring. Cortex and flake blank surfaces also occurred on the finished tools and debitage. These attributes are often present in many of the archaeological samples.

Once the triangular preform was produced, the tool was finished by basal or corner notching. The exact location of this notching has often lead to the classification of these tools as different point types. The difference between Eva/Morrow Mountain, and Cypress Creek points is little more than the location of one or two notching flakes. Despite the specific location of the notches, the basic manufacturing techniques for these three point types remain the same.

Kirk point production incorporated an additional series of flakes beyond those removed in the production of Eva/Morrow Mountain points. This additional flaking gave these points a flatter and smoother cross-section. Mild platform grinding, in conjunction with shearing, and antler billet percussion were used during the advanced thinning stage. To produce a finished Kirk point similar to those found in the archaeological sample, it was necessary to maintain maximum width at the distal as well as proximal end of the preform. Rectangular preforms of this type were recovered in the Early Archaic components of the midden mound sites. There is a distinct difference between this preform shape and the triangular Eva/Morrow Mountain preform. Thinning takes place at both the proximal and distal ends and produced more debitage with right angle intersecting dorsal scars. Additional thinning caused an increase in dorsal complexity in the debitage produced. More pressure flaking was used for the finishing of Kirks than for Eva/Morrow Mountains. A deer mandible was used for serration and corner notching. Distinct cone-shaped notching flakes were often produced by this technique.

The percussion thinning of Greenbriar points was similar to that of Kirks and is presented in Figures 41-45. The biconvexity and surface attributes of Greenbriars were most easily attained through serial pressure flaking. Several series of pressure flakes were removed in their production. To replicate the archaeological specimens, a slightly wider-tipped antler pressure flaker was used for Greenbriar finishing than was used for Kirks. Percussion or pressure basal thinning (fluting) was used to finish the tool.

Sykes-White Springs and Benton points were manufactured in very similar ways. While the Sykes-White Springs points were produced from cobble flake blanks, the Benton points were replicated from flake blanks derived from blocks of blue-gray Fort Payne. These tools are perhaps the most complex in terms of flaking technology, and the reduction stage products are presented in Figures 38-40. The advanced level of thinning used in their production was unique because of the critical level of isolated platforms preparation necessary to produce a biface with a plano/plano cross-section. Platform grinding was used to prevent platform collapse which would result in hinged and stepped flake failures.

To attain a plano/plano biface it was necessary that the thinning flakes reach more than half way across the biface. This enabled the reduction of biface thickness faster than biface width. This technique produced a high percentage of flat flakes with opposing dorsal scars. While hammerstones may be used to produce this tool type, an antler billet was preferred by the replicator. Overshot flakes are a more common type of flake failure in the production of plano-plano points. It appears that the more advanced the knapping that takes place the more uniformity that exists between the debitage produced by the manufacture of individual pieces. A distinctly different type of pressure flaking characterizes these points. While the other point types were finished using an inward pressure flaking technique, these plano-plano points were finished using a downward pressure flaking technique. With inward pressure flaking the flake removed skims over the surface of the biface. Pressure is applied with the tool hand-held. Inward pressure flaking involves the use of marginal platforms. In contrast, downward pressure flaking is most easily accomplished by placing the tool on an anvil and short, abrupt flakes are snapped or popped off by non-marginal downward pressure. This process produces the distinct beveling typical of Benton points.

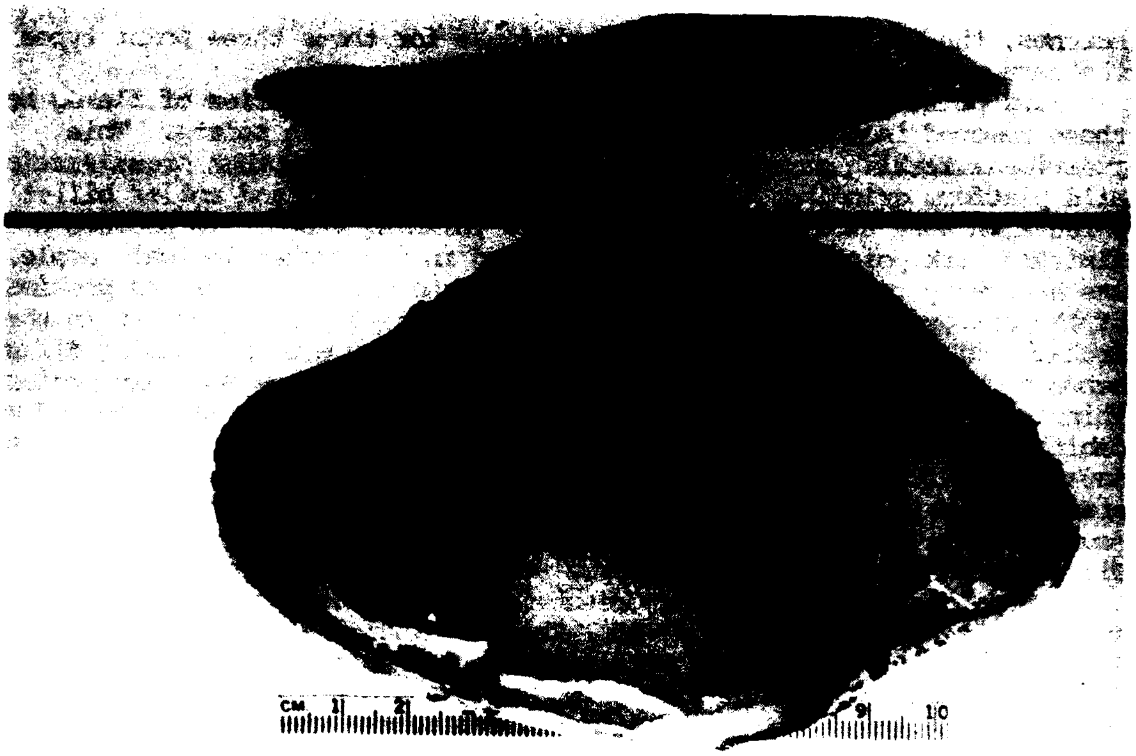


Figure 41 Flake blank for Greenbriar biface manufacture.

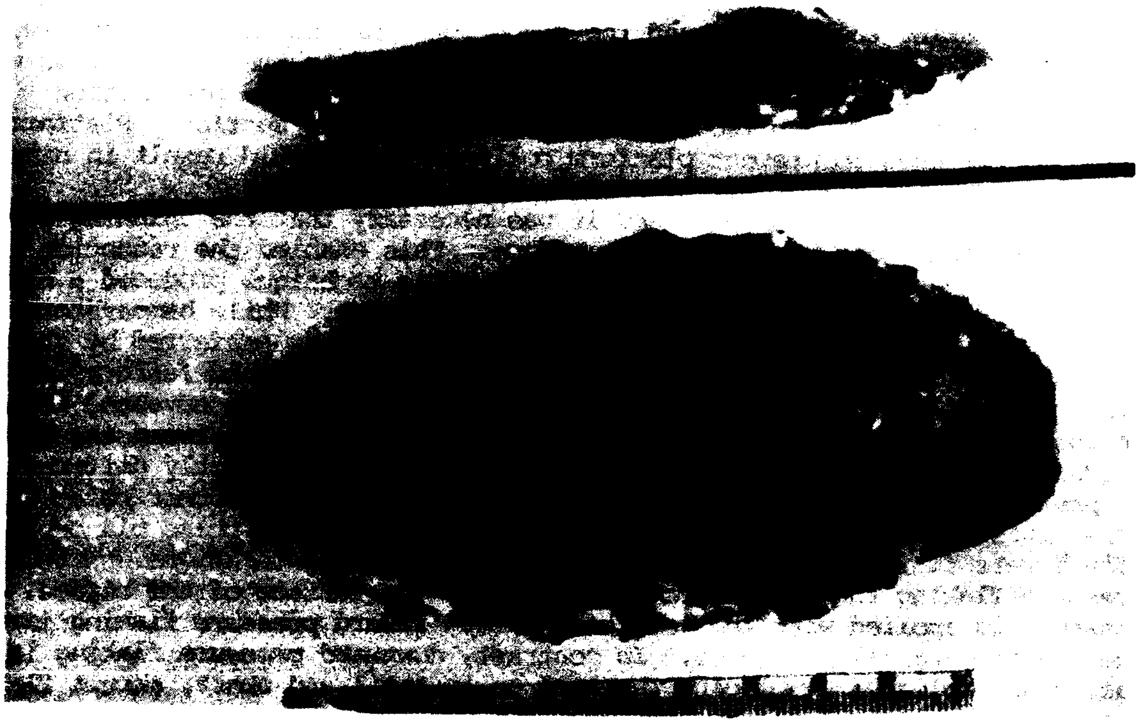


Figure 42 First thinning of flake blank for Greenbriar biface.

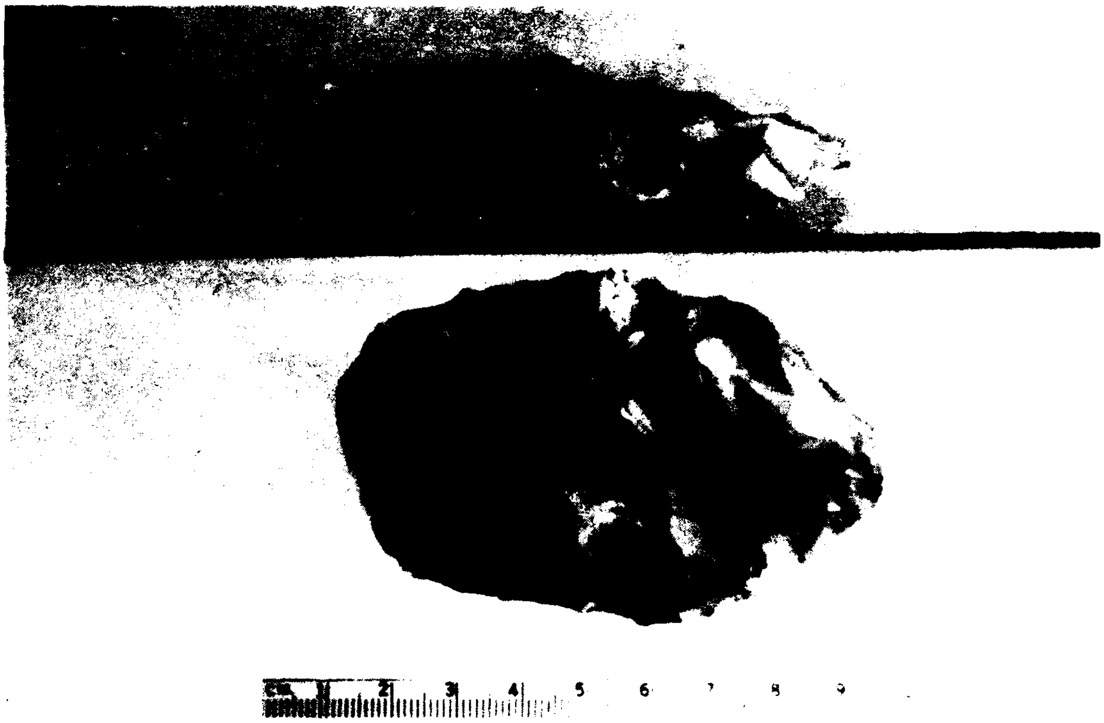


Figure 43 Second thinning of flake blank for Greenbriar biface.

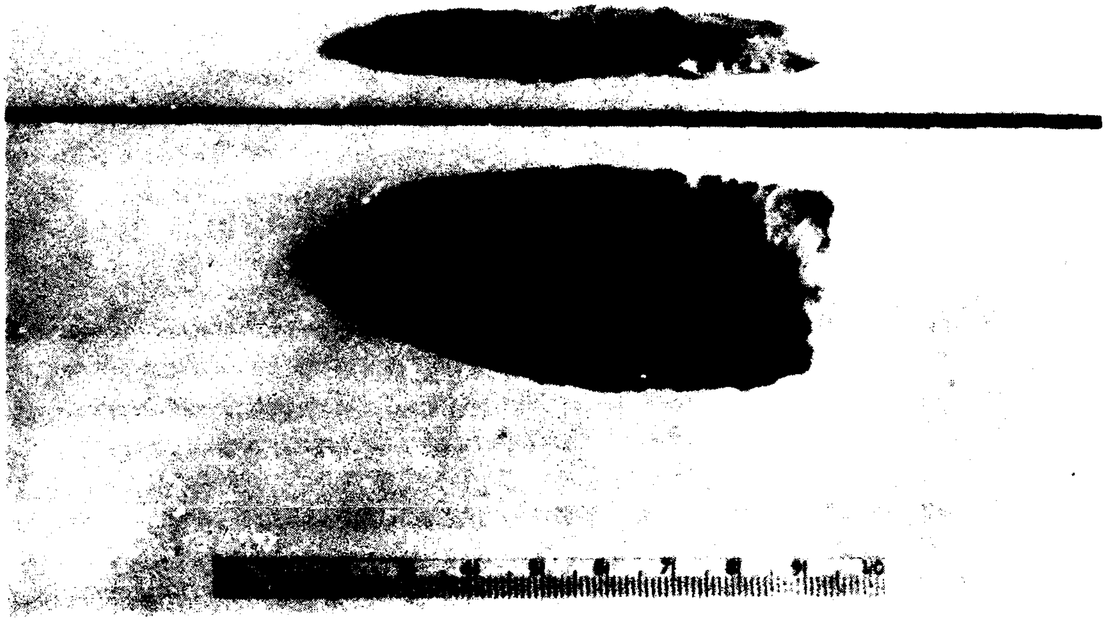


Figure 44 Trimming of flake blank for Greenbriar biface.

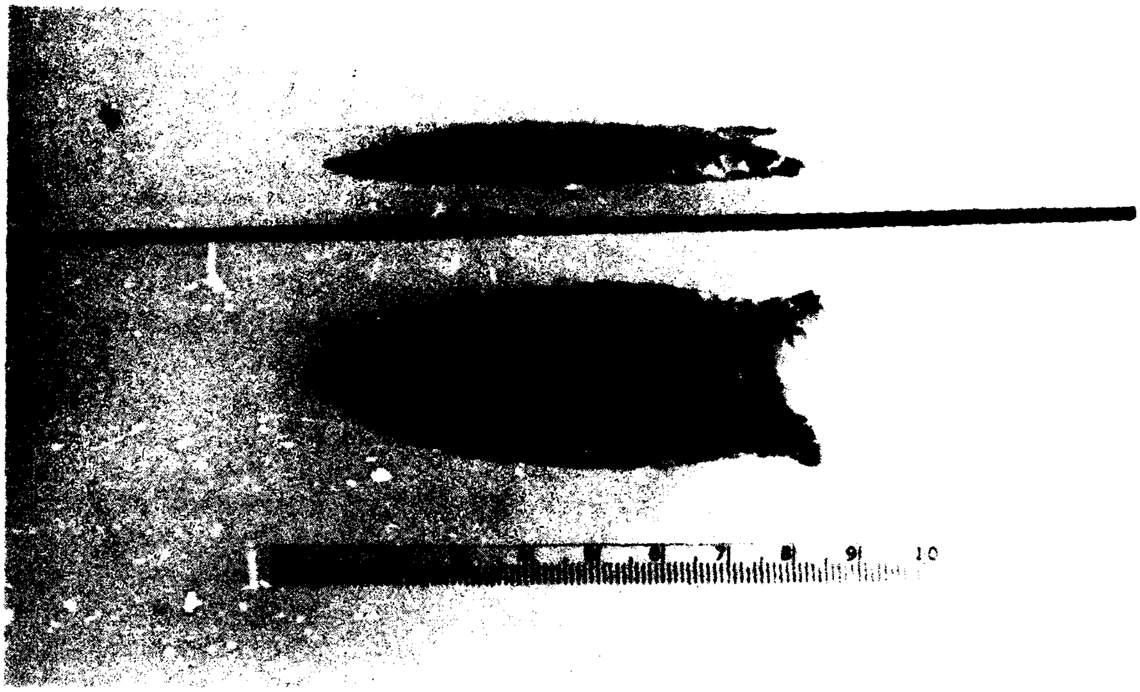


Figure 45 Finished Greenbriar biface.

5. Fort Payne Flake Blank Reduction - Ten Fort Payne flake blanks were reduced for the production of Benton points described above. Large flake blanks were removed from large blocks of Wilson Dam Fort Payne chert. This step was not carried out in a controlled manner - no debitage was collected because it is documented that this manufacturing procedure did not occur at the sites investigated and because of the highly flawed nature of the collected materials. This dark blue-gray Fort Payne can not be successfully heat treated and is a much harder stone to knap. The flake blanks were reduced through the edging and initial thinning, secondary thinning, and finishing stages similar to the production of Sykes-White Springs points.

Several kinds of information were recorded for these reduction sequences (Table 8 Appendix III). These included variables of the original whole cobble and its reduction sequence: cobble raw material, length, width, thickness, weight, amount of cortex present, reduction type (bipolar, free hard hammer for flakes, narrow biface production, and broad blade production), reduction stage, and cobble end product(s) (rejected material, flakes, or specific point types). Other variables were recorded for intermediate tool forms and finished tools. Each product of cobble reduction that was used in biface manufacture was assigned an item number. Length, width, thickness, and weight for each item were recorded after each manufacturing stage. The amount of cortex remaining on a piece after each stage was also noted.

After each manufacturing stage, flakes that could be used for other small tools were removed from the debitage. The remaining debitage was collected as a batch after each manufacturing stage and was sorted using 1-inch, 1/2-inch, 1/4-inch, 1/8-inch and 1/16-inch square mesh hardware cloth. The screens used were the same ones used to sort the archaeological debitage during Phase I and II. Within each size grade, debitage was counted and weighed, and the number of pieces with cortex was recorded. After removing usable flakes, the debitage produced from bipolar and free hard hammer reduction for flakes was processed in the same manner. In addition to the above flake information collected for mass analysis (Ahler 1982), individual flakes were placed into nine categories based on polythetic criteria developed by the replicator. The definitions of these categories are given in Table 9 of Appendix III. Raw data files and SAS data files for the replication experiments are available on tape.

Summary statistics for the intermediate products and end products of small and medium cobble reduction were calculated (Table 97), and several observations can be made about the reduction of the experimental bifaces:

TABLE 97
Mean dimensions of original cobbles and bifaces produced at stages in reduction sequences.

	N	Mean	Standard Deviation
Reduction Sequence 1			
Original Cobbles Reduced by Hard Hammer Methods for Flakes			
Length	12	107.65	20.49
Width	12	76.26	13.17
Thickness	12	49.58	10.60
Weight	12	547.60	228.95

TABLE 97

Mean dimensions of original cobbles and bifaces produced at stages in reduction sequences (continued).

	N	Mean	Standard Deviation
Reduction Sequence 1			
Exhausted Cores from Hard Hammer Reduction for Flakes			
Length	3	76.03	18.87
Width	3	55.10	6.46
Thickness	3	33.87	4.92
Weight	3	126.40	50.34
Reduction Sequence 2			
Original Pebbles Reduced by Bipolar Methods for Flakes			
Length	12	58.67	7.17
Width	12	38.43	7.14
Thickness	12	26.87	4.56
Weight	12	71.58	18.99
Reduction Sequence 2			
Exhausted Cores from Bipolar Reduction			
Length	7	37.39	5.30
Width	7	26.21	6.82
Thickness	7	17.09	7.61
Weight	7	24.37	25.53
Reduction Sequence 3			
Small Cobble Reduction for Narrow Blade Bifaces (Little Bear Creek)			
Length	3	98.23	18.40
Width	3	57.50	5.58
Thickness	3	43.13	9.96
Weight	3	258.20	160.84
Combined Small Cobble Reduction and Initial Edging and Thinning Product			
Length	10	59.03	9.44
Width	10	32.86	8.19
Thickness	10	13.33	2.81
Weight	10	28.86	18.80
Combined Secondary Thinning and Pressure Finishing - Finished Tool			
Length	11	56.57	8.67
Width	11	21.74	2.67
Thickness	11	9.90	1.84
Weight	11	10.57	3.94

TABLE 97
Mean dimensions of original cobbles and bifaces produced at stages in reduction sequences (continued).

	N	Mean	Standard Deviation
Reduction Sequence 4a			
Medium Cobble Reduction End Product Broad Blade Biface (Kirk)			
Original Cobble			
Length	4	95.60	5.47
Width	4	68.86	2.05
Thickness	4	45.05	12.73
Weight	4	307.32	63.81
Flake Blanks and Nuclei			
Length	10	70.67	17.39
Width	10	49.02	10.04
Thickness	10	18.12	8.25
Weight	10	68.14	69.29
Edging and Initial Thinning Products			
Length	10	65.78	16.01
Width	10	40.88	7.48
Thickness	10	13.56	5.08
Weight	10	43.83	30.87
Secondary Thinning Products			
Length	8	56.91	16.26
Width	8	31.62	5.11
Thickness	8	7.91	1.14
Weight	8	15.39	9.18
Finished Tools			
Length	10	55.61	14.26
Width	10	30.99	4.41
Thickness	10	7.07	2.35
Weight	10	13.52	7.80
Reduction Sequence 4b			
Medium Cobble Reduction End Product Broad Blade Biface (Greenbriar)			
Original Cobble			
Length	2	126.10	19.52
Width	2	86.55	28.77
Thickness	2	59.20	10.61
Weight	2	691.45	536.91
Flake Blanks and Nuclei			
Length	9	91.86	21.12
Width	9	69.10	13.85
Thickness	9	20.11	4.56
Weight	9	122.72	71.20

TABLE 97
Mean dimensions of original cobbles and bifaces produced at stages in reduction sequences (continued).

	N	Mean	Standard Deviation
Reduction Sequence 4b - Medium Cobble Reduction End Product Broad Blade Biface (Greenbriar)			
Edging and Initial Thinning Products			
Length	9	78.77	21.44
Width	9	49.60	13.98
Thickness	9	13.90	3.29
Weight	9	56.88	35.70
Secondary Thinning Products			
Length	9	74.31	20.81
Width	9	34.47	5.35
Thickness	9	9.94	3.03
Weight	9	28.91	16.67
Finished Tools			
Length	7	74.71	23.01
Width	7	29.49	4.47
Thickness	7	8.10	1.82
Weight	7	20.96	14.33
Reduction Sequence 4c Medium Cobble Reduction End Product Broad Blade Biface (Eva/Morrow Mountain)			
Original Cobble			
Length	3	99.97	18.07
Width	3	69.27	4.34
Thickness	3	48.90	5.30
Weight	3	379.10	84.63
Flake Blanks and Nuclei			
Length	11	75.17	10.49
Width	11	55.45	7.37
Thickness	11	21.69	4.79
Weight	11	75.70	36.17
Edging and Initial Thinning Products			
Length	9	55.90	13.58
Width	9	39.38	4.97
Thickness	9	12.58	4.99
Weight	9	31.21	21.73
Secondary Thinning Products			
Length	4	55.12	6.31
Width	4	35.17	3.22
Thickness	4	9.67	0.97
Weight	4	17.00	2.74

TABLE 97
Mean dimensions of original cobbles and bifaces produced at stages in reduction sequences (continued).

	N	Mean	Standard Deviation
Reduction Sequence 4c			
Medium Cobble Reduction End Product Broad Blade Biface (Eva/Morrow Mountain)			
Finished Tools			
Length	8	52.61	5.87
Width	8	34.46	2.50
Thickness	8	9.07	0.75
Weight	8	13.87	2.99
Reduction Sequence 3d			
Medium Cobble Reduction End Product Broad Blade Biface (Sykes-White Springs)			
Original Cobble			
Length	7	104.43	6.95
Width	7	82.97	12.56
Thickness	7	46.44	10.28
Weight	7	437.67	126.46
Flake Blanks and Nuclei			
Length	21	80.09	14.38
Width	21	55.19	15.61
Thickness	21	23.47	8.53
Weight	21	110.53	108.75
Edging and Initial Thinning Products			
Length	18	66.53	19.62
Width	18	37.34	11.89
Thickness	18	14.10	5.30
Weight	18	35.55	16.23
Secondary Thinning Products			
Length	9	74.31	11.16
Width	9	36.24	8.75
Thickness	9	10.86	5.07
Weight	9	32.23	22.17
Finished Tools			
Length	6	73.12	10.54
Width	6	28.58	2.12
Thickness	6	7.65	0.95
Weight	6	17.47	6.00

TABLE 97
Mean dimensions of original cobbles and bifaces produced at stages in reduction sequences (continued).

	N	Mean	Standard Deviation
Reduction Sequence 5			
Fort Payne Blank Reduction for Broad Blade Biface (Benton)			
Original Blank			
Length	10	113.97	14.17
Width	7	76.10	7.37
Thickness	10	24.20	4.83
Weight	10	289.96	55.49
Edging and Initial Thinning Product			
Length	10	96.98	15.04
Width	10	55.49	14.13
Thickness	10	17.34	4.96
Weight	10	101.29	50.21
Secondary Thinning Product			
Length	8	88.89	13.11
Width	8	39.59	8.16
Thickness	8	10.42	5.29
Weight	8	40.20	22.46
Finished Tool			
Length	5	81.26	10.89
Width	5	32.38	4.36
Thickness	5	8.34	1.30
Weight	5	24.54	7.51

1) A relatively small number of cobbles was necessary to produce material for all the finished bifaces. On the average, each cobble produced at least two flake blanks or nuclei for further reduction. The number produced depended on the size and quality of the original cobble. Only nuclei and flake blanks of suitable size and those without major flaws were selected for further biface reduction. The largest cobble used to manufacture Greenbriar bifaces yielded one large nucleus and four large flake blanks. Many smaller flakes suitable for the manufacture of patterned unifacial tools and edge retouched flake tools were also produced from this cobble.
2) A large number of cobbles were needed to produce the five finished Sykes-White Springs bifaces, because large nuclei or flake blanks are necessary for their manufacture. These bifaces were knapped toward the end of the replication sessions. The medium-sized cobbles remaining for tool manufacture did not provide more than one flake blank of both sufficient size and quality for the manufacture of these plano-plano bifaces. If raw material supplies were in any way limited prehistorically, suitable cobble material for their manufacture might be difficult to obtain.
3) Not surprisingly, the greatest material loss occurs during the process of cobble reduction and edging and initial thinning. The loss of material decreases as tools become more refined. Variation among items generally decreases with refinement.

4) Regardless of whether nuclei or flake blanks are used at the beginning of the manufacturing sequence, width and thickness are fairly uniform for the finished products. Length is more variable.

These data can be compared with statistics archaeological specimens examined during Phase III to provide insights about tool manufacture and use. For example, when the mean length, width, thickness, and weight of named hafted bifaces are compared, the archaeological specimens are sometimes wider and thicker than the experimentally produced items, but they are all shorter on the average (Table 98). The difference is greater for Sykes-White Springs and Benton bifaces. This suggests that the archaeological specimens might have been resharpened. If resharpening does not occur along the entire edge, i.e. if it is resharpened in the haft maximum artifact width would not be reduced.

TABLE 98
Mean length, width, thickness, and weight for whole named hafted bifaces.

Class	N	Mean	Standard Deviation
Greenbriar			
Length	5	62.34	13.92
Width	5	27.50	2.38
Thickness	5	7.94	1.44
Weight	5	12.78	5.13
Kirk			
Length	10	47.74	5.88
Width	10	28.55	4.39
Thickness	10	7.44	1.07
Weight	10	9.98	3.34
Eva			
Length	4	44.40	10.08
Width	4	32.15	3.60
Thickness	4	9.68	1.47
Weight	4	12.12	2.58
Morrow Mountain			
Length	10	49.63	8.53
Width	10	33.97	4.69
Thickness	10	8.72	1.25
Weight	10	12.34	5.08
Cypress Creek			
Length	5	49.74	3.36
Width	5	39.54	4.81
Thickness	5	10.22	1.37
Weight	5	18.40	5.43
Sykes/White Springs			
Length	8	48.31	7.20
Width	8	32.40	2.80
Thickness	8	9.30	2.19
Weight	8	12.28	3.25
Benton			
Length	20	58.04	11.93
Width	20	28.43	3.62
Thickness	20	7.66	1.09
Weight	20	12.87	4.50

Archaeological examples of Greenbriar and Kirk bifaces are more standardized along these measured dimensions than their experimental counterparts, while Eva/Morrow Mountain, and Cypress Creek bifaces are much less standardized. Archaeological examples of Greenbriar and Kirk bifaces appear to be more refined, while the others, especially the Cypress Creek bifaces, appear to be more irregular both in plan and side view. Several possible explanations can be proposed for these differences: tool function may differ among the biface types; prehistoric knapping skills and the skills of our replicator may be different; concerns with standardization may not have been the same during various prehistoric time periods and in the experimental design; and, finally, sampling may be a problem.

USE-WEAR EXPERIMENTS

Limited use/wear experiments were conducted in the lithic study. Work by Keeley (1977) and Odell (1979) among many others over the past few years shows that rigorously controlled experiments and detailed record keeping are essential to successful results. Among other things, researchers might want to control for different types of raw material, whole tool size, edge configuration, tool edge angle, number of strokes or length of time an edge was used, the motion with which a tools is used, and the type of material on which the tool is used. Record keeping ideally includes the macroscopic and microscopic description, including drawings and or photographs of each tool or tool edge before use, a description of the use episodes, and the detailed microscopic description, also including drawings and photographs of the tool or tool edge after use. The more repetitions of each type of tool use the better the chances of identifying consistent patterns of tool modification.

Because it was not possible to conduct a rigorous, full-scale set of use-wear experiments, assignment of function to tools or tool segments in the Phase III lithic study based on the existing literature on micro-wear analysis, is to some extent general. To answer the research questions it was necessary to be able to:

1. Recognize when a tool or tool segment had been used. This requires the ability to distinguish among edges or projections modified through use, intentional manufacturing processes, and post-depositional alteration.
2. Recognize different patterns of tool use. Although experiments were conducted on different kinds of materials with different motions, they did not encompass all possible combinations; therefore, the patterns that were produced on our experimental pieces could possibly be produced by other means as well as the ones we used. It is important to distinguish different patterns of use-wear if they occur on a single tool and to distinguish patterns among tools, even if there is uncertainty as to the kind of activity which created these patterns. This ability makes it possible to discuss intensity of tool use and multipurpose tool function.
3. To be able to evaluate the relevance of other use-wear experiments to the archaeological sample. Because use-wear patterns can differ with raw materials, it was essential to carry out experiments with materials relevant to the archaeological sample. Comparisons of wear patterns on these raw materials with those in the literature served as a guide to the pertinence of the existing literature to this study.

A type collection of fresh breaks and unused edges was made to accomplish this first requirement. This collection included trampled flakes collected from the knapping area outside the laboratory. This area had been used for recreational knapping with Camden, Pickwick, and Fort Payne cherts. The flakes were collected before the area was used for any use-wear activities. Bifaces broken during replication experiments also provided examples of fresh breaks.

Approximately 50 trampled flakes and fifteen broken tool edges were examined using a stereo zoom microscope at 10-70 power. Most of the breaks on trampled flakes are transverse, transverse with lip or diagonal. Breaks on tools were perverse, transverse, transverse with lip and fractures due to natural flaws, see below of definitions of fracture types. Microflaking in the form of three to four contiguous, triangular or scalar flakes occurs on about one-third of the these broken edges. Small, triangular nicks along the edge were sometimes associated with this microflaking. Flake scars range from less than 1-2 mm long. Microflaking occurred most often on fractures with thin lips. The microflaking seemed to be the results of the same force or forces which caused the whole flake or tool fracture. Broken edges were sharp rather than smoothed or rounded. Ten of the trampled flakes and all of the broken bifaces from replication experiments have been retained for our type collection.

Laboratory personnel observed the manufacture of bifaces in which edge preparation was an important step, and they were able to examine these replicated items at various stages of manufacture. In addition, five bifaces (10 edges) with edge preparation were made for our type collection. Four edges were sheared with an antler billet; six edges were ground - four with a piece of sandstone, two on cement. Sheared edges are slightly crushed, with small, even flakes extending from the crushed edge onto one face. The bulbar axis of the flake scars form an approximate 60° angle with the tool edge. Flake scar terminations are primarily feathered. Ground edges are relatively smooth and usually rounded, i.e. there is no sharp break between the tool edge and surfaces. When grinding extends onto the surfaces of a piece, prior flake scar ridges are smoothed over. Occasionally striations are present parallel to the tool edge. When grinding extends onto the surfaces of a piece, prior flake scar ridges are smoothed over. Grinding on cement created a flat facet on the tool edge in one case. Distinct ridges separated tool edge and surfaces.

Use-modified edges and projections were created on unmodified flakes, flakes with retouched edges and on bifacial hafted tools (Figures 46 and 47). All tools were made of Camden chert except in cases noted below. All Camden bifacial tools, except Little Bear Creek #2, were heat treated. Except for those flakes with the letters "UF" in their identifying number, flake tools are not heat treated. All tools were sketched before use, and tool edges were examined microscopically. All pre-use edge modification were noted. Examples of recording sheets are given in Figure 1, Appendix III. Tools were usually used for tasks that were likely to have been done by prehistoric populations; for example, hide preparation, making tool hafts and foreshafts from oak or cane, splitting bone to create awl blanks, and spear throwing. The motions used in these tasks and the amount of time each edge was used were recorded. Repetition of tasks was not consistent and depended on materials, tools, and time available. After use, tool edges were cleaned with weak solutions of hydrochloric acid and sodium hydroxide and examined microscopically (Table 99).

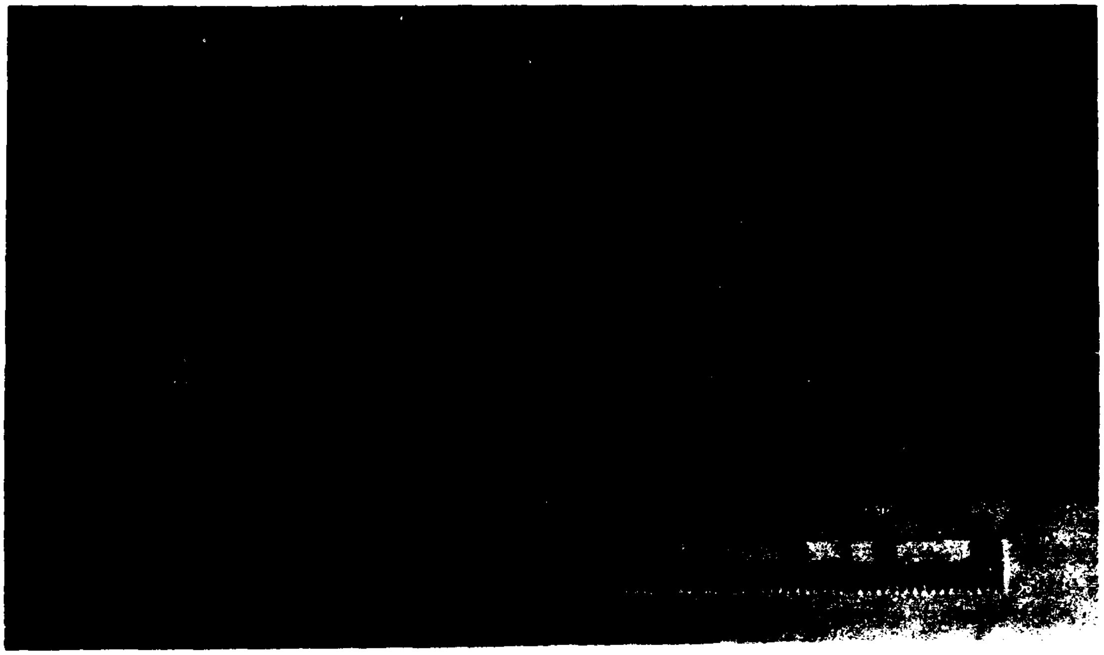


Figure 46 Hafted end-scraper used in use-wear experiments.

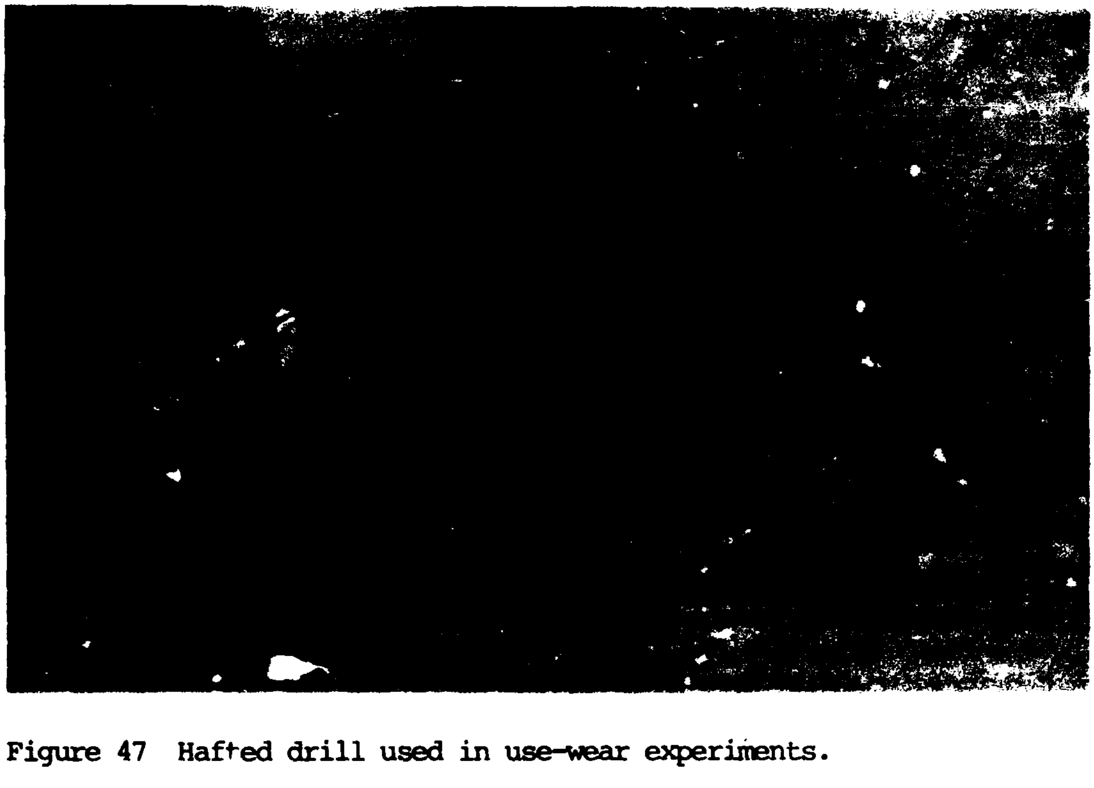


Figure 47 Hafted drill used in use-wear experiments.

TABLE 99
Number of tools and edges used in use-wear experiments.

	Activity					
Material	Cutting/ Sawing	Scraping/ Planing	Drilling	Graving	Splitting	Throwing
Soft						
fresh deer hide	7* (9)**	1 (1)				
chicken	7 (10)					
Medium						
cane	6 (7)	1 (1)			1 (1)	
oak	3 (3)	5 (5)	2 (2)		4 (4)	3 (3)
dry hide		3 (3)				
Hard						
bone	5 (8)	2 (2)	3 (3)	8 (17)	1 (1)	4 (4)

* number of tools
** number of functional units

In addition to the tools used in our experiments, 28 unmodified used flakes stored in protective envelopes were loaned to the project for study by the lithic replicator. These include six wedges of Fort Payne chert used on bone, three wedges of Fort Payne chert used to split wood, one flake used to skin a fatty raccoon, 11 flakes used to cut deer sinew, three flakes used to cut deer skin or meat, four flakes used to saw, plane, and chisel wood. The last 19 items are made of Coxsackie chert, a dark blue-gray chert from New England.

The following use-wear patterns were present on the experimental tools:

CUTTING/SAWING

BONE: Two hafted bifaces (Benton #1 [Fort Payne] and Little Bear Creek #2) and three flakes (flake #31, #45 and #2) were used to saw bone. After a total use time of approximately 20 minutes for two edges, one functional unit on flake #31 exhibited small flake rectangular flake scars with step terminations. Wear was primarily on one side of the edge, since the tool was used at a 45° angle to the bone. The other functional edge is cortex. This edge became rounded. No microflaking occurred. Flake #45 (total use time for 2 edges: 13 minutes) edges showed small triangular flake scars with step terminations on both faces, although flake scars were more invasive on one face than the other. Edges wore down very quickly. One functional unit on flake #2 was used in a sawing motion but at less than a 90° angle to the worked bone. Flakes one-third the size of retouch flakes were removed from one side of the edge. Flake scars had step terminations. After a total use time of 26 minutes for both edges, serrations on hafted biface #2 were worn down, and edges appear crushed. Wear was most evident on the middle of the edge segment. After about 13 minutes of use on each edge, edges became noticeably dull. After a total use time of 57 minutes on one edge only, Biface #1 developed an almost ground appearance on the very edge. All high spots along the edge were obliterated. Flake scars with step terminations extending onto both faces developed, although it was sometimes difficult to separate flake scars removed through manufacture and use. One edge that had been use on wood and had developed rounding and polish was used on bone (Benton #4). After 90 minutes of use, rounding and polishing were obliterated by crushing and flake scars with step terminations developed.

CANE: Three hafted bifaces (Benton #4 [Fort Payne], Kirk #3, Little Bear Creek #5), one unhafted biface (Eva/Morrow Mountain #1) and two flakes (#5 and #13UF4) were used to cut cane. After an average use time 45 minutes, biface edges became blunt rather than crushed. Blunt edges were not as smooth or regular as ground edges, but did not exhibit the more extreme removal of material seen in crushing. At 50-70 power blunt edges are composed of short, overlapping, rectangular flake scars with step terminations. Flake scar ridges and step terminations due to manufacture were smoothed over. Wear was primarily on the middle of the edges. After 90 minutes of extended use of Kirk #3, one functional unit appeared rounded and had developed a slight polish. The serrations on biface #5 wore down in the first five minutes of use. Flakes #13UF4 (total use time 30 minutes for two edges) and #5 (total use time three minutes on one edge) were hand-held. Flake scars were removed from both sides of used edges. Scars are scaler. Wear was more extensive on the middle of the used edges.

OAK: Three tools were used for cutting oak branches, one hafted Benton (#1) and two flakes (#45FB4 and #39). The Benton edge became blunt after 30 minutes. Smoothing of manufacturing flake scar ridges occurred further up the faces of the edge than occurred on cane cutting edges. The used edges on both flakes appeared blunt or rounded under 40 power magnification after ten minutes. Scalar flake scars with both feathered, and step fractures were removed primarily from one side of each used edge.

FRESH MEAT/HIDE: Three hafted bifaces (Kirk #4, Benton #1 [Fort Payne] and Benton #3 [Fort Payne] and four flakes (#10UF1, UF5 and UF6, #22UF2) were used partially to dismember nine chickens. No attempt was made to avoid chicken bone. A wooden cutting board was used, and after use the cutting board had 175 small cuts and two puncture marks. The bifacial tools were used for a total of 23 minutes. Both edges of each bifacial tool were used. After use on the chickens and microscopic examination, these bifaces were resharpened and used on wood and bone. The flakes were used for a total of 25 minutes. Tools seemed to become ineffective after a very short period of use. This was probably due to the accumulation of grease or fat on the edges, rather than to edge modification. Brose (1975) noted that flakes used in butchering are usually used for short periods of time (three to four minutes). They become ineffective because of the accumulation of animal fat. The short period of use may leave no traces of wear. Unhafted tools were also difficult to hold once they became greasy. Bifacial tools showed no wear that could be attributed to use on the chickens. None of the bifaces were used long enough to alter in any way we could measure the flake scar ridges or the slightly crushed edges produced during manufacture. Three of the four flakes used (#55UF1, #22UF2, and #10UF6) showed wear in the form of very shallow, bifacial, scalar or amorphous flakes with feather terminations. Edge segments may appear wavy and smooth. Two of the flakes also have small nicks removed from edge segments.

DEER: Three of the four flakes numbered flakes (55UF2, 22UF1, and UF2) used to skin a deer showed traces of wear. Both sides of used edges exhibit irregularly spaced, shallow, amorphous flake scars and small shallow scallops. Occasionally small, shallow flakes of a triangular or rectangular shape have been removed from the edges. Several of the edges also had small scattered nicks. These are probably due to contact with bone. Three unmodified, unnumbered Fort Payne blades were also used on the deer. These were not examined microscopically before use. Each of the flakes were used for about five minutes. Although all three had excellent cutting edges, they were difficult to hold. Wear similar to that on the three Camden flakes developed on all five of the functional units used.

All but one of the 13 flakes used to cut deer skin or meat and to cut deer sinew showed similar wear. Edges have shallow amorphous flake scars with feather terminations. Clumps of more defined flake scars, and isolated flake scars with step terminations and nicks are probably the result of contact with bone. These flakes are on the whole larger than those made of Camden or Fort Payne, and a few are backed. They may have been easier to hold.

SCRAPING/PLANING

BONE: The fracture edge of a broken biface (#22N) was used to scrape bone. The edge had an approximately 90° edge angle. After 35 minutes of use the edge was obviously rounded and smoothed. Flakes were removed from the edge in contact with the bone, but these were quickly smoothed over. One edge of flake #37 was also used to scrape bone. After 30 minutes the edge showed very little wear. Fifty power magnification revealed only slight polishing on the very edge.

DRY HIDE: Three hafted unifacial scrapers (scrapers #2, #3, and #4) were used to scrape dry hide. In all three cases extreme rounding and polishing occurred on the edge and extended on to the dorsal side (the side with greatest contact with the hide) obliterating dorsal flake scar ridges. The rounding was apparent after as little as 15 minutes. The polish was matte, but apparent at relatively low magnification (25 power). On two edges striations perpendicular to the working edge developed. Only one microflake was removed from all of the scraping edges. Those scrapers with the most regular edges in plan and side view were the most effective scrapers.

CANE: One flake (#5) was used to scrape cane. Small, scaler flakes were removed from one side. No rounding occurred. The edge was used for 10 minutes.

OAK: Five flakes (#10, #19, 20, #30UF1, #13UF5) - average use time for 5 edges = 30 minutes - were used to scrape oak branch segments used to make tool handles. Three edges exhibit even, small, scalar flake scars primarily on one side. At 40-70 power, edges also appeared to be rounded and smoothed. One cortex edge and one edge of chalky material have few flake scars. Edges were smoothed and rounded. The smooth appearance on one piece extend up one face more than the other.

FRESH HIDE: One bifacial hafted scraper (#1 [Fort Payne]) (Figure 46) was used to flesh a fresh deer hide. The tool was used with both a pushing and pulling motion and was usually held at a 45-75° angle to the worked material. Wear developed very slowly. After almost two hours of use, slight rounding and smoothing ("smearing") of manufacturing flake scars was noticeable at 40 power magnification. No microflaking occurred. With this prolonged used the tool became very ineffective. Brink (1981) comments that fleshers were probably resharpened often. If this is so then traces of wear on tool used for this purpose were difficult to detect. And if they occur, they will be away from the tool edge.

DRILLING

BONE: Three hafted bifacial drills (drills #1 [Fort Payne], #4 and #5) with diamond cross-section were used to drill deer bone and antler. The tips of both drills used on deer bone appeared crushed. Several flakes popped off of one drill tip when it entered the marrow cavity. The sides of the drill shafts were also blunted, and one drill showed a slight polish on one edge. The drill used on moose antler developed crushing and some medium-sized flake scars with step terminations after about 15 minutes of use. It then snapped. The edge was resharpened and use continued. Crushing and step fractures developed again. Sides of the drill became blunt.

OAK: Two hafted bifacial drills (#2 and #3) (Figure 47) were used to drill pieces of oak. After 15-45 minutes tips were rounded and very smooth. Slight polish seems to develop. Manufacturing flake scar ridges on the sides of the tools are smoothed

GRAVING/GROOVING

BONE: 17 projections on eight flakes (#1, #2, #16, #30, #31, #32, #37, and #51) were used to produce grooves on deer bone. All tips were crushed soon after use. Then small flakes originating at the tip were removed. Flakes were longer than wide and had step terminations. These "new" tips then became crushed and then again flaked. The tips of these tools seemed to resharpen themselves. The sides of the projections become smoothed or rounded with use. Projections were used from 4-40 minutes. The usefulness of the projections depended on their length and cross-section.

SPLITTING/POUNDING

BONE: One flake (#10UF3) was used to split a section of deer bone during the manufacture of a bone awl. One edge was sheared to create a platform for billet blows. The edge in contact with the bone rapidly developed edge damage. Large flakes with step terminations were removed along both sides of the edge. High spots along the edge were crushed. With continued use the edge became covered with stacked step fractures. The opposite sheared edge was struck with an antler billet and shows crushing along the edge, but damage is not extensive. The six wedges on loan to us show large rectangular flake scars, longer than they are wide, with step terminations on the edges in contact with bone. Wear on the opposite end of the tool varies with the type of percussor used. Antler billets seem to produce little damage, while hard hammers leave crushed or at least pockmarked surfaces.

OAK: Four wedge-shaped pieces (#3UF2, #7UF1, #35, and #38) were used to split oak branches during the manufacture of tool handles. None of these tools was used for more than four minutes. Edge damage produced included large, rectangular flake scars with both feather and step terminations on both sides of the edge in contact with the wood. There was little edge crushing. The surfaces struck by an antler billet (two tools) showed little damage. Only a few small 'dimpled' areas are present. This type of damage was difficult to interpret as use-wear on archaeological specimens. The two pieces struck with a hammerstone had more extensive battering.

IMPACT

Seven biface points (Eva/Morrow Mountain and Kirk types) were mounted in cane foreshafts and shafts. Oak trees and a large moose antler plate were used as targets. Several types of impact fractures were produced. One point completely shattered on impact with the antler plate. Fractures on the pieces recovered are very irregular, and although they are not as smooth, they are similar to heat-produced crenate fractures. Two have stacked step fracture emanating from the tip, and three have single large flake scars originating from the tip. The flake scars show pronounced rippling. One point which was thrown against wood had a transverse fracture with tongue. In the process of hurling these spears, targets were missed and points struck the ground. No impact fractures resulted. Our target practice was of a very informal nature. The type of fracture that occurred on points was no doubt due to the force with which the spear was thrown, the angle at which it struck the target, as well as the type of material struck.

MISCELLANEOUS

One drill was used to pry ice off of a refrigerator freezer. The tip snapped producing a transverse fracture with a smooth tongue. A flake used for an hour to skin a fatty raccoon shows little wear. Only one small section at the end of the flake shows shallow flake scars.

The wear patterns described above are similar to those summarized by Lurie (1983) and to those described in Brink (1981) and Huckabay (1981). Some additional observations on particular raw materials are given below:

1. Cortex seems to collapse with use. There is little microflaking no matter what kind of task is performed. Functional units become blunt or rounded rather than flaked.
2. Scraping wood with low edge angles produces microflaking quickly, but edges then become rounded obscuring the flake origins.
3. Wear is more apparent on heat-treated flakes. Used edges may be easier to identify if there is luster contrast between the flake surface and the used edge, or heat-treated material may flake more easily.

SECTION 4: VARIABLE SELECTION AND ARTIFACT RECORDING SCHEMES

The artifact recording scheme used for the 6,391 stone artifacts examined as part of the Phase III analysis contains three types of information for most variables: 1) the rationale for selecting a particular variable to record; 2) a discussion of attribute states, and their definitions when appropriate, for each variable; and 3) the conventions employed in assigning these attribute states. Examples of the scheme with appropriate computer information and examples of the artifact recording sheets are provided in Table 10 and Figure 2 in Appendix III. Raw data files and SAS data files for all tools coded in the Phase III study are available on tape. Variables will be discussed under the following headings: provenience, raw material, heat treatment, technology, function, hafting, and morphology. It should be noted that many of the variables provide information on more than one of these topics. Terms given in capital letters indicate the name of variables. Terms in quotation marks are attribute states.

PROVENIENCE: Provenience includes the site number, excavation block letter, excavation level, feature number when appropriate, an arbitrary field number assigned to excavation units or sections of excavation units, and artifact catalogue number. The site number, ID, and catalogue number together indicated a unique item. Both inter- and intra-site comparisons can be made using these units. Units were assigned to one of the six time categories (Early Archaic, Middle Archaic 1, Middle Archaic 2, Middle Archaic 3, Middle Archaic 4, and Late Archaic). This facilitates testing expectations about changes in tool manufacture and use.

RAW MATERIAL: In the preliminary analysis of all lithic material from the midden mound sites, 35 types of raw materials were defined. Of these a relatively small number make up over 95% of all the artifacts recovered: Camden chert, yellow chert, blue-gray/tan Fort Payne chert, fossiliferous Fort Payne chert, ferruginous sandstone, Tallahatta quartzite, Pickwick chert, and Bangor chert. Other types of materials that occur infrequently include non-Tallahatta quartzite, quartz, conglomerate, hematite, limonite, and a number of exotic cherts. Camden, Pickwick, and yellow cherts, quartz and quartzite pebbles, ferruginous sandstone, and conglomerate are derived from the Tuscaloosa formation that cap the uplands in the north and east of the study area and may have been present in the Tombigbee Valley as alluvial gravel. These lithic materials were considered local raw materials in this study.

Four geological formations (Tuscaloosa, Fort Payne, Bangor, and Tallahatta) supply the vast majority of raw materials. Of these the Tuscaloosa formation (Marchen and Stearns 1962), capping the uplands to the north and east of the study area, was the most extensively exploited. It was the parent material for most of the alluvial sand, gravel, cobble, and boulder deposits contained Camden, Pickwick, and Yellow cherts, quartz, and quartzite pebbles, ferruginous sandstone, and conglomerate. These lithic materials are considered local raw materials in this study.

CAMDEN CHERT: Camden chert occurs as well-rounded cobbles with a cortex from 1-2 mm thick. It is highly variable in color, texture, luster, and workability. The most common colors range from white to yellow to olive yellow (2.5Y8/2, 2.5Y8/4, 2.5Y8/8, 2.5Y7/8), although some pieces are light gray to gray (2.5YN7/, 2.5YN/). Grain size ranges from fine to coarse, and several colors and textures are often found in the same cobble. Luster ranges from dull to medium, and knapping quality ranges from poor to fair. The material is often "very hard and tough" to knap when unheated (Kalin, personal communication: 1985).

YELLOW TUSCALOOSA: Yellow chert also comes in well-rounded cobbles with a thin cortex. Color ranges from yellow to yellowish brown (10YR6/6 and 10YR5/8) and is uniform throughout the cobble. Grain varies from fine to coarse even within the same cobble. Luster varies from dull to medium. Flaking quality ranges from poor to good.

PICKWICK: Pickwick chert outcrops in the Fort Payne formation in the western middle Tennessee Valley, particularly Pickwick Reservoir. Pickwick chert has also been reincorporated into the Tuscaloosa formation. Cobbles are distinct because of their banding or mottling. Three colors are usually present blue-black to dark gray (5B4/1, 5BN4/, 5BN6) at the cortex, yellow to whitish yellow (10YR8/3, 10YR8/8, 10YR7/8), and red (2.5YR 6/8-4/8) at the center. The material found in the Fort Payne formation normally has a higher porosity, medium to coarse grain size, and dull to low luster, but flaking is fair to good. Pickwick chert incorporated in the Tuscaloosa formation has medium to fine grain due to re-silification. Luster is dull to medium, and flaking quality is fair. The material found in Pickwick Reservoir forms in flat, angular cobbles with heavy cortex, but the redeposited Tuscaloosa cobbles are rounded with a thin cortex.

FERRUGINOUS SANDSTONE: Ferruginous sandstone is found in the Tuscaloosa and other Upper Cretaceous formations in the research area. Quartz sand grains are cemented by silica and iron compounds which give it a reddish black to black color (2.5YR3/4, N2.5/). It is coarse grained, but can have a medium to medium-fine luster on fresh breaks in well-cemented pieces. Although flaking quality can be fair in strongly cemented specimens, most of the tools made from this material have been pecked or ground, either intentionally or through use.

CONGLOMERATE: Conglomerate is composed primarily of rounded or subangular yellow chert fragments greater than 2 mm in diameter cemented by a fine-grained matrix of quartz grains, iron oxides, and silica. This is a coarse-grained material with medium to medium-fine luster on fresh surfaces. Flaking is fair in well-cemented specimens. Conglomerate was often used for large, heavy-duty tools.

The closest outcrops of the Fort Payne formation are in the middle Tennessee Valley in the extreme northeastern corner of Mississippi approximately 75 km (46.5 mi) from the sites investigated (Smith 1898).

FORT PAYNE CHERT: Fort Payne chert is highly variable, ranging from light gray or blue to blue-gray, dark gray, or black (7.5YR N 7/, 5B 7/1, 5B 4/1, 7.5YR N2), with blue translucent mottles occurring in some of the darker varieties. The lighter colored, more coarse grained forms could become yellow or tan with weathering (10YR8/6 and 10YR6/8). Most of the Fort Payne cherts has a porous, medium to coarse grain, although some of the darker specimens are more compact and have finer grain. Luster ranges from dull to medium-high, with darker specimens having higher luster. The flaking quality ranges from fair to excellent. Nodules often have a thick cortex of rough-grained coarse chert which must be removed to reach the more workable, finer grained interior.

FOSSILIFEROUS FORT PAYNE: The fossiliferous forms of Fort Payne range from light gray to blue-gray, to blue, white, tan, and brown (10YR7/2, 5BG6/1, 5BG5/1, 10YR8/2, 10YR7/6, 10YR6/8) with fossils normally being a slightly darker opaque shade than the surrounding matrix. The grain and fossil size seems to correlate with the chert color. The darker blue-gray and blue forms have a medium-fine grain size and highly fragmented small fossils peppered throughout the nodule, while the lighter colored cherts have a medium to coarse texture with larger and more varied sizes of fossils. Finer cherts have a medium luster. The coarser cherts exhibit a dull luster or no luster at all. This material often forms in thick, blocky nodules, with square block fractures, which have medium to thick pitted cortex. The flaking quality is fair to good. The majority of fossils are crinoid fragments, but the key Fort Payne formation fossil indicators are specific brachiopods, and the absence of Bryozoa.

The closest source of Bangor chert to the midden mound sites was approximately 80 km (49.6 mi) to the east (Bond 1980). Fossiliferous forms of Bangor chert derived from the thick-bedded, dark bluish limestone usually occur as blocky slabs, while non-fossiliferous types occur as rounded nodules.

BANGOR CHERTS: Three types of Bangor chert (Blue-Green, Little Mountain Bangor and fossiliferous Bangor) were described in the Phase I Interim Report. Of these only Blue-Green and fossiliferous Bangor are present in the Phase III sample. Blue-Green Bangor ranges in color from light blue-green through dark blue-green, and sometimes dark gray (5BG6/1, 5BG4/1, 5Y4/1). It is usually uniformly colored, although sometimes there was a shift in color shade from the exterior to the interior of a cobble, with the darker shade on the interior. It is fine grained, and thin flakes tend to be translucent. The luster is medium to high, and flaking quality is fair to excellent. It occurs in irregular, flat to round nodules and has a calcareous cortex. Fossiliferous Bangor has a similar color range. Fossil fragments often appear translucent white. Key index fossils include Bryozoa. The background matrix surrounding the fossil inclusions is fine grained, but sometimes the fossils have been leached out, leaving voids in the chert. Luster is medium to high. Nodules are normally thick and blocky with square fracture planes.

The Tallahatta formation (Copeland 1968) is found in outcrops across south-central Alabama and central Mississippi. This is the most distant source of lithic materials (160 km or 99.2 mi from the research area) commonly used for midden mound tool manufacture.

TALLAHATTA QUARTZITE: Tallahatta quartzite is a sandstone that has been metamorphosed to quartzite by silica cementation. Tallahatta is recognized by the sparkle of its crystal grains, and is sometimes referred to as sugar quartz (Lloyd et al. 1983). This medium to coarse-grained material varies in color according to its degree of weathering - from gray and blue-gray with white mottles when fresh to opaque tan when weathered (2.5YN8/, N7/, 7/2, N6, 6/2) (White 1981). Relatively coarse grain and poor cementation causes Tallahatta quartzite to erode rapidly. When freshly broken flaking was fair to good, but after artifact manufacture weathering obliterates flake scars.

Fort Payne, Bangor, and "Other" cherts as well as Tallahatta quartzite are considered nonlocal raw materials.

Other raw materials used in small quantities for tools include iron ores, hematite and limonite, petrified wood, and greenstone. These were described in the Interim Reports.

Raw material type was scored for all archaeological specimens. Type was based on the University of West Florida's comparative collection as well as the previous descriptions. If items did not match any of the samples in the collection, they were sorted as "Other chert" or "Other Raw Material." The amount of cortex on a tool or piece of debitage was also recorded to the nearest 5%. The amount of cortex on the tool is often an indicator of reduction stage and manufacturing technique.

Raw material quality was scored for all chert. Evaluation of chert as good, fair, or poor was based on texture, the presence of fossil inclusions, and the presence of fracture planes. On the whole, the quality of Camden chert, by far the most common raw material in the collection, is good. The quality of very small pieces of chert, or chert pieces that had been overly damaged by heat, were scored "can't determine." At present there are no criteria established for evaluating the quality of stone commonly used for ground stone implements.

HEAT TREATMENT: The application of heat to chert often causes visual and structural changes in the material. The series of heating experiments conducted to document changes in color, luster, and workability in Camden, Pickwick, and Fort Payne cherts has been described in Section 3 of this chapter. Prehistorically, cherts could had been intentionally heated as part of the manufacturing sequence or heated accidentally, or heated both intentionally and unintentionally. Both intentionally heated and unintentionally heated pieces can exhibit the same characteristics of color and luster. Heat treatment is the term usually used to indicate the intentional heating of materials to improve their knapping quality. In the absence of prehistoric heat-treatment facilities, it is not possible to measure intentional heating directly, but the selection of heated pieces for tool manufacture can be documented (Belim and Green 1981). In the recording system the variable HEAT TREATMENT refers to pieces with characteristic color, luster, and possibly pot lid fractures and crazing, resulting from heat application, that have been worked, and/or used after heat application. This selection of materials implies an intention to heat.

Because different cherts respond in different ways to the application of heat, samples of unheated and heated materials must be available for comparisons. The heat-treatment experiments provided a comparative collection of unheated and heated Camden, Pickwick, Fossiliferous Fort Payne and Wilson Dam blue-gray Fort Payne used to evaluate heating. If heated and unheated samples of raw materials were not present in the type collection, and if there was no difference in luster on heated surfaces and flake scars indicating pre- and post-heating surfaces, archaeological pieces were scored "Can't Determine" for heat treatment. HEAT TREATMENT was scored as "present", "possible", "absent", "can't determine", or "not applicable", for all non-chert raw materials.

The variable HEAT TREATMENT POINT OF OCCURRENCE pertains to the stage in the manufacturing sequence in which heat treatment occurs. It was scored for pieces which had HEAT TREATMENT recorded as present or possible. Attribute states for this variable include: "cobble/core stage," "flake blank stage," "biface stage," "can't determine," and "not applicable." Pieces scored "absent," "can't determine," or "not applicable" for HEAT TREATMENT were scored as "not applicable" for HEAT TREATMENT POINT OF OCCURRENCE.

HEAT ALTERATION refers to those pieces that have been heated but not subsequently worked or used. Heat-treated pieces can also be heat altered. For example, a roughly formed biface can be heated as part of the manufacturing sequence and then further reduced to produce a finished tool. This tool can subsequently be broken due to further application of heat and discarded. The second application of heat will be characterized by various forms of heat fractures and by smoked and burned surfaces. The scoring for heat alteration includes information on the state of manufacture attained at the time of heat alteration. HEAT ALTERATION was scored "absent," or "present" at the cobble/core, flake blank, or biface stage," or "present on a finished tool," "can't determine," or "not applicable." Although ground stone tools were scored for this variable, the criteria used were more nebulous. Burned sandstone exhibits color change and has a crumbly texture.

TECHNOLOGY: TECHNOLOGICAL CLASS identifies the reduction strategies used to produce tools. This assessment was made on the basis of tool attributes such as the initial form of the modified piece, the mode of modification, and the amount of shaping the tool has undergone. This variable provides a way to evaluate the investment of energy in tool manufacture as well as a way to describe manufacturing techniques and the selection of these techniques through time. Many of the attribute states reflect the results of the experimental program, as well as preliminary visual inspection by the project lithic specialists. Ground stone items were grouped under three attribute states primarily to reflect energy expenditure. These include intentionally shaped ground stone items, such as use-modified ground stone, and unidentified ground stone fragments.

Several technological class attribute states in the recording scheme are for items normally considered debitage of various sorts. These attributes were included to account for items classed as utilized flakes and chunks (during Phase I and II), but assessed as debitage in Phase II. Many were fire spalls without any apparent retouch or use wear, while others were resharpening flakes whose ground or crushed platforms served as the basis for their original classification as tools.

Biface cross-section is helpful in evaluating manufacturing techniques, point styles, and, in some cases, function. For example, in the experimental program, reproduction of Kirk, Eva/Morrow Mountain, Sykes-White Springs, and Benton points consistently produced items with different cross-sections. These cross-sections were related to the type of blank used, and flaking sequence. The diamond cross-section of most drills is likely related to their function. Five named cross-section shapes are included among the attribute states in the recording scheme: biconvex, plano-convex, plano-plano, rhomboidal, and diamond. Irregular cross-sections were scored as "other." In most cases the cross-sections of broken bifaces were recorded as "can't determine." Non-bifacial artifacts were recorded as "not applicable."

The GEOMETRIC SHAPE in plan view of all relatively whole pieces was recorded. Geometric shape is important in describing stages of biface manufacture and point styles, measuring energy investment in tool manufacture, and assessing tool function. Attribute states include "ovoid", "round", "teardrop", "triangular", "rectangular", and "square" shapes, an "amorphous-shape" category, and an "other" category. Ground stone tubular beads and drilled cores were coded as "rectangular."

PRESSURE FLAKING OR RESHARPENING PATTERN is a variable which applied to shaped artifacts only. It records the pattern of pressure flaking in terms of two techniques, inward verses downward application of pressure. Inward pressure produces relatively long, narrow flakes with feather terminations, while downward pressure produces relatively short, wide flakes with more abrupt terminations. Either one or both of these techniques could have been used to produce beveled edges often associated with particular point styles, tool functions, or resharpening techniques. Serration, the production of a sawlike edge, is also considered a pattern of edge modification on shaped tools. Combinations of inward pressure, downward pressure, and serration were included in the attribute states. If a biface exhibited none of the above modifications, it was scored as having "no consistent pattern." Biface fragments with only small edge sections were scored as "can't determine" for this variable.

COMPLETENESS OF LAST FORM has three attribute states, whole, broken or can't determine and was recorded for all items. The completeness of artifacts in an assemblage could reflect several types of behaviors, such as intensity of tool use, methods of artifact disposal, and prehistoric trampling. A piece was considered whole if the entire outline was represented. Small nicks along an edge that could have been caused prehistorically or during excavation or storage were not treated as breaks.

The variable **ELEMENT PRESENT** records that part of an artifact which has entered the archaeological record. This variable allows sorting of artifact categories which contain comparable information. For example, pieces of undetermined element, corner fragments and edge fragments will not contain as much information or will give misleading information about the amount of tool manufacture, use, or curation at a site, since many of these items represent parts of the same tool too small to refit. If segment type can be identified, their numbers and distribution within a component are more meaningful. For example, broken projectile point bases may have been brought back to camp attached to tool shafts. These broken proximal ends could have been reworked or discarded in an area of retooling.

For shaped pieces, the distal end refers to the functional end of the tool and the proximal portion to the butt end or hafting end. For tools with discernible flake morphology, the distal end is the flake termination, and the proximal end is the striking platform end. Tool midsections have neither the proximal or distal end, although a proximal or distal end can contain the midsection or part of the midsection. It was often difficult to judge the completeness of ground stone tools. The edges of worked items were examined for abruptness of break, and potential fractures were examined for rounding and/or weathering. Many had to be scored as "can't determine."

Although fracture mechanics have been important in explaining why flakes of certain sizes or shapes are detached with various types of percussors and help explain why breaks of certain configurations occur when too much, too little, or poorly placed force is applied, the behavioral implications for the range of tool fracture patterns found at archaeological sites has not been fully explored. Johnson (1982) suggests that fracture patterns could be related to tool life cycles. Some fractures were the result of manufacturing errors, some result from use, and some from disposal practices. He recorded a number of fracture patterns that occurred on artifacts from the Yellow Creek Archaeological Project in northeast Mississippi. The initial impetus for recording fracture types for midden mound artifacts comes from the Yellow Creek study. Any correlations between variables which record stages of tool production (PRODUCTION STAGE), tool use (FUNCTION), and fracture types are of special interest.

In addition to Johnson's work, Callahan's (1979) description of fractures that occur during the manufacturing process have contributed to our understanding of the fracture process. Samples of these fracture types were produced during the experimental program. Additional examples were loaned to the project by the lithic replicator from his own collection of knapping failures. These formed a type collection of fracture types with which archaeological specimens could be compared. The following definitions of fracture types were used in the recording scheme.

1. Direct fractures - fractures that initiate at the point of force application.
    a. Perverse fracture - The perverse fracture (Crabtree 1972:821) is a twisting direct fracture which results "when the fracture plane

twists on an axis of rotation corresponding with the direction of force" (Johnson 1981:46). The points of force application, bulbar surface or negative bulbar surface, are often recognizable on these fractures.

b. Overshot fracture - [reverse fracture (Johnson 1981:44-45) outrepasse (Crabtree 1972:80)- Overshot fracture refers to biface thinning flakes which remove the opposite bifacial edge from which the flake was struck. This type of fracture can occur at all stages of reduction. Incorrect striking angle is a common cause for this type of fracture (Callahan 1979:85). Both overshot flakes and the truncated bifaces that they create were found in archaeological context.

c. Direct surface fracture - These fractures result from the application of force to a flat, thin surface rather than to an edge. This force may or may not be intentional. The fractures exhibit partial hertzian cones or radial pattern, and the point of force application can be distinguished.

d. Impact fracture - These are direct fractures which create longitudinally oriented flake scars originating at the distal end of a biface (Ahler 1971:52).

2. Indirect fractures - Fractures which occur away from the point of force application. Both Johnson (1981) and Callahan (1979) make the dichotomy between indirect and direct fractures. Ahler (personal communication) points out that many transverse and diagonal fractures originate at the point of impact, but that they are less "violent" than perverse fractures. Fractures along natural flaws can also occur at point of impact.

a. Transverse - [lateral snap (Johnson 1981:47; Purdy 1974:134): end shock fracture (Crabtree 1972:60)]. Transverse fracture is a type of indirect fracture which results in a straight break relatively perpendicular to the long axis of a tool or flake. It occurs "when the force of the thinning blow exceeds the elastic properties of the raw material" (Johnson 1981). Johnson reports that these fractures occurred primarily on unfinished bifaces in the Yellow Creek sample and, therefore, were probably production failures. One of the by-products of the midden mound experimental program was the creation of many of Johnson's fracture types. Three variations of transverse fractures were recognized: transverse fractures which are straight in cross-section, transverse with lip which has a gentle or fairly sharp bend at one margin, and transverse with tongue which has a more gradual curved cross-section. This last type of fracture occurred when experimental pieces were used to pry hard material, or as the result of impact on hard surfaces.

b. Diagonal - diagonal fractures assume the same forms as transverse fractures, but are not perpendicular to the long axis. It is only possible to distinguish between transverse and diagonal fractures when the long axis of a piece can be determined. Fractures which were 70° or less to the longitudinal axis were considered diagonal. When the longitudinal axis of a piece could not be determine, fractures were considered to be transverse.

c. Fracture along natural flaws - Fractures which initiate or follow internal fracture planes or small crystal inclusions. Many of the raw materials used in our experimental program showed internal fracture planes often coated with iron staining or lined with crystalline formations that could predispose the material to fracture in a way unintended by knappers.

d. Heat Fractures - Heat fractures can take several forms: the smooth, curved, jigsaw-like crenate break (Purdy 1975, 1973; Johnson 1981:49; Rick 1978); the pot lid fracture, a shallow bowl-shaped section popped off of a surface without any evident point of origin (Rick 1978); and finally the expansion fracture which consists of "large pot lid fractures turned sideways so as to truncate a biface," i.e. the pot lid will occur on the fracture plane (Johnson 1981:50). Expansion fracture for the midden mound project also includes groups of overlapping small pot lid fractures which occur on the fracture surface of a broken piece and fracture surfaces covered with so many small, overlapping pot lids that the break has an almost a sugary texture. This type of fracture occurred almost exclusively on dark blue-gray Fort Payne chert.

e. Haft snap - Haft snaps occur at the juncture of a tool blade and its haft element. The fracture configurations most often associated with haft snaps are transverse, transverse with lip, and transverse with tongue. Johnson considers this break to be the result of tool use. This relatively narrow area of the tool was presumably securely anchored to a shaft and most susceptible to fracture under stress.

Combinations of these fracture types are also possible. Categories were established for those combinations that occurred most commonly on experimental pieces or that seemed common in a cursory examination of archaeological specimens. Whole pieces were scored as "not applicable" for this variable.

PRODUCTION STAGE was recorded for all artifacts. Assignment to attribute states were to a great extent based on a combination of other variables in the recording scheme including technological class, various attributes of shape, and edge finishing, as well as evidence of use. Experimental work provided type specimens with which to compare archaeological ones. The aim of recording production stage was to place an item within a manufacturing sequence which includes the following:

1. Core/core fragments - blocks or chunks of raw material with evidence of flake removal.
2. Stage 1 bifaces - crude bifaces analogous to the nuclei produced during early biface reduction or the biface products of initial edging and thinning. They are irregular in plan and side view and usually show no evidence of wear. Most of the items in this group are probably knapping failures of one sort or another.
3. Stage 2 bifaces - bifaces comparable to the products of secondary or advanced thinning in the experimental program. They are medium refined bifaces more regular in plan view and cross-section than Stage 2 bifaces, but their edges have not been pressure flaked into a definable pattern. They usually show no evidence of use-wear, but they can exhibit edge preparation. These pieces were probably broken through knapping errors.
4. Stage 3 bifaces - highly refined bifaces, regular in both plan view and cross-section, although pressure flaking or resharpening patterns along edges are lacking. They do not have hafting elements and usually show no evidence of use wear. Edge preparation is often present.
5. Finished tools - finished bifaces and other chipped, shaped, and ground stone. Finished bifaces are technologically complete in terms of the production of hafted narrow or broad blade items. Most of the pieces show

evidence of use and/or resharpening. Unifacial tools were placed in this category based on amount of shaping and the presence of use wear. Other chipped tools were placed in this category if they showed evidence of use wear. Technology as well as wear help place shaped ground stone in this variable. Ground stone modified through use only was considered a finished tool.

Broken items as well as pieces that showed a combination of characteristics that made it impossible to be placed in any of the above categories were scored as "can't determine." Unaltered chipped or ground stone was scored as "not applicable" for this variable.

USE PHASE is also a composite variable and admittedly subjective. It was designed to place an item within its use and disposal context rather than within a manufacturing sequence. Used items need not be finished tools. Descriptions of the attribute states for this variable are as follows:

1. Tools are considered unused if they show no evidence of use-wear. Shaped tools that appear finished but had no evidence of use were scored as "unused", although tentative functions could be assigned to them under the FUNCTION variables.
2. Used and still useful items have discernible use-wear and are whole, or enough of the functional unit is present on broken pieces, so that, in the estimation of the recorder, the tool could still be used for its original function.
3. Used and discarded tools are items that have use-wear but are no longer complete enough to perform their original function. They have not been resharpened or recycled subsequent to breakage.
4. Resharpened and still useful items have resharpened edges and are whole or whole enough, so that in the estimation of the observer its original function could be performed. The usefulness of these items is very subjective, indeed, since use-wear has often been obliterated by the resharpening, and the original function can only be implied. Resharpened and discarded tools have evidence of resharpening and are broken in such a way that the recorder felt that the original function of the tool could not be performed.
6. Recycled and still useful pieces have been reshaped and/or reused for some function other than its original one. Common types of recycled tools are broken biface points that have been reworked into a bifaces with transverse working edges and broken bifaces with the used fracture edges. Others are tool fragments which have projections that can be used for incising or graving.
7. Recycled and discarded pieces are the same as above, except that the functional unit with evidence of the recycled function is heavily worn or broken.

FUNCTION: Study of tool function has a special orientation. The precise use of a tool is of no special interest, but information on intensity of tool use, multipurpose tools, utilized flakes, and recycling is significant. The assignment of a function, or functions, to tools when possible was based on evidence of microscopic edge damage. Interpretations of edge damage were based on use-wear experiments and detailed descriptions of wear reported in the literature (Ahler 1971; Odell 1974, 1979, 1981; Keeley 1979; Brink 1982). Macroscopic attributes such as edge angle and edge configuration were used in conjunction with microscopic evidence (Lurie 1983).

Because it is possible for different parts of the same tool to be used for different tasks, the appropriate functional unit ("FU") of analysis is the employable unit defined by Knudson (1973) as

> "that implement segment or portion (continuous edge or projection) deemed appropriate for use in performing a specific task, e.g., cutting, scraping, perforating, drilling, chipping. The unit was identified by deliberate retouch and/or apparent post-production utilization modification, and its boundaries were defined subject to the analyst's own concept of 'habitual use.'"

For example, a hafted pointed biface has three FUs, the tip and two lateral margins. If only the tip shows traces of use, the biface has only one function unit. If the tip and both margins have been used, and one margin exhibited two kinds of wear, then the biface has four functional units. The concept of employable unit has been used by Odell (1980), Joslin-Jeske (1981), and Lurie (1982) to analyze large collections of artifacts, as well as in Phase III. It should be noted, however, that tool configurations also provide information that must not be ignored in making functional interpretations. Tool mass, shape, and the relationship between employable units were often important clues to function in our analysis.

Not all tools in Phase III, however, exhibited edge damage. When edge damage was not present, a tentative function was assigned to shaped, finished tools on the basis of position of retouch, edge angle (Wilmsem 1968), edge configuration, and, in some, cases artifact mass (Lurie 1983). Tentative function is a useful concept for tools that may have been used on soft materials, or for tools used very briefly, since they develop wear slowly or not at all. For the purpose of analysis, it was important to separate these tools from those showing actual traces of wear. These tentative functions were labeled "potential" in the recording scheme. Although the assignment of tool function based on morphology alone was a questionable procedure, the criteria for making these assignments was as explicit as possible.

It is often difficult to distinguish microflaking due to manufacture from use-wear especially on edge-retouched pieces (Keeley 1975: Brink 1982). Shearing, a manufacturing technique used to back tools or to prepare edges, can also be interpreted as use-wear. Similarly it is difficult to separate use-related microflaking on unmodified edges from unintentional "wear" caused by prehistoric trampling, recent trowel or shovel activity, and storage procedures. The manufacturing and use experiments conducted as part of this project provided information on several of these problems. This information and other more arbitrary conventions were used to distinguish use from other types of edge alterations. The following conventions were used:

1. Flaking was considered retouch rather than use if the flake scars extend more than 1 mm onto the surface of a tool. Assuming that retouch could be more regular than use-wear, edges with flake scars of mixed size were considered use-wear, especially if the majority of the flake scars were less than 1 mm.
2. Sheared edges with flake scars greater than 1 mm in length were considered retouched edges. If there was no further evidence of edge alteration, these edges were considered unused unless they were opposite other used edges. If they were located opposite used edges, the sheared retouch edges were scored as possible tool backing. Sheared edges with flake scars less than 1 mm in length were considered use-wear of some kind.

3. An attempt was made to distinguish manufacturing edge abrasion from use-related edge damage. During manufacture of bifaces edges were often sheared or ground to strengthen platforms. The edge produced was similar to one with use-wear that might had developed during cutting or sawing abrasive material. If abraded edges were due to edge strengthening, it could be expected that the abraded edge would be less localized on pieces that were not highly refined. On refined tools they could be broken by flake scars subsequently removed from the prepared edge, or they could be restricted to specific areas such as hafting elements or blade shoulders.
4. Differences in patination and flake scar angle were used to identify recent edge alteration caused by excavation techniques and bag wear. A shovel or trowel that scrapes or chunks into a tool edge produces microflaking, but these flake scars are often triangular with terminations perpendicular to the tool edge. Fresh flake scars will be lighter in color than the rest of the tool if it was made from some variety of Camden chert and darker if the tool was made from blue-gray Fort Payne. Bag wear was characterized by small, isolated nicks or flake scars along an edge. Flake scars are lighter or darker than the rest of the tool depending on the type of raw material from which the tool was made. Neither of these kinds of edge damage produce smoothed or rounded edges.
5. Most utilized flakes in the sample had fragmentary functional units. They were recorded as used, but function unknown.

All pieces were examined using a stereoscopic microscope (American Optical or Bausch and Lomb Stereo Zoom) at medium power (10-70 power). When edge damage was encountered, a sketch of the piece was made, and the area of use noted. In the recording scheme there were four variables allotted to function (FUNCTION, FUNCTION 2, FUNCTION 3, and RECYCLED FUNCTION). The variable attributes were the same for each of these. The number of functional units having a specified function was also recorded. In this method of recording there was no need for combined use categories.

For the purposes of this study low-edge angles were 0-45°, medium-edge angles 46-75°, and steep-edge angles 76° or greater. The angles measured were the spine angle (Tringham et al. 1974) or preparation angle (Lurie 1983). Measurements were taken with a goniometer. Edge configuration refers to the shape of an edge in plan view and the shape of an edge in side view. Hard materials were stone, antler, and bone. Medium materials were wood, cane, and other vegetable matter. Soft materials were meat, fresh hide, and sinew. Grasses and dry hide were considered separately since wear produced by these materials seem to be very distinctive.

Cutting/sawing refers to unidirectional and bidirectional motions, respectively. Generally a cutting or sawing tool will be held at an angle approximately 90° to the material worked. Motion will be parallel to the tool edge. Wear beyond the immediate edge should occur on both faces, but the extent of facial wear will depend on depth of penetration. Scraping could be unidirectional or bidirectional. Scraping tools were usually held at approximately 90° to the material worked. Motion will be perpendicular to the tool edge. Wear onto a face or faces will depend on whether the motion was unidirectional or bidirectional, as well as on the hardness of the material worked. Planing, whittling, and drawing were unidirectional motions perpendicular to the tool edge. Tools were held about 30° to the material worked. Wear will be greater on one face than the other. Chopping was a unidirectional motion delivered 45-90° to the material worked. Adzing was a unidirectional motion at an angle up to 45° to the worked surface.

The description of the Midden Mound lithic study units has focused on stylistic, technological, and functional aspects of Archaic tools. Tool morphology, a combination of all these three aspects, often obscures variation in assemblages that occurs along one of these more specific lines of inquiry. For the sake of comparison the numbers and percents of artifacts in each morphological class are presented by site and time category.

FUNCTIONAL CATEGORIES

01 No use-wear apparent. The piece is too incomplete to assign a tentative function.

02 Potential cutting soft material. Low angled employable units that are straight to sinuous in side view. These edges or edge segments are usually produced by bifacial retouch.

03 Potential cutting/sawing medium to hard material. Employable units with medium-edge angles, straight edges (side view), and serrations or denticulations (plan view) fall into this category. Since it was expected that wear would develop quickly on hard to medium materials, few tools appear in this category unless a cache of finished but unused tools is found.

04 Potential piercing soft material. Employable units are thin points or projections that seem to be intentionally produced. Edges of the projections may or may not be retouched.

05 Potential piercing/drilling/graving medium to hard material. Employable units are thick points or projections, including burin type bits.

06 Potential scraping soft material. Employable units have medium to steep edge angles, rounded edge configurations in plan view so that the material worked will not be cut or nicked and straight edges in side view so that there is maximum contact with the material to be worked. Edges may be unifacially of bifacially worked.

07 Potential Scraping/Planing hard material. Employable units are steep and straight in both plan and side view. They are usually unifacially shaped and edge retouch is also unifacial.

08 Potential Chopping. In this case function is based on edge angle, configuration, artifact shape and size. Tools of this sort are relatively large with straight edges and medium to steep edge angles. They may be hand-held or hafted.

09 Possible backed edge. See convention 2 above.

10 Used edge. Type of use can not be determined. Broken used edges often fall into this category, since patterning of flake scars can not be determined.

11 Cutting/sawing soft material. Employable units have low edge angles with straight to sinuous edges. Edges are lightly smoothed or rounded. Microflakes when present on an unretouched edge would have feather terminations. Smoothing extends up both faces of the artifact, both within flake scars and on flake scar ridges.

12 Cutting/sawing medium material. Employable units will have smoothed over or rounded edges. Step fracture due to manufacture are often smoothed over. Wear will extend onto both faces of the tool, however, since the material worked is not soft, wear on the faces is restricted to flake scar ridges and is not as invasive onto the face of the tool as in cutting soft material. It is possible that striations will also be present. If so, they will be parallel to the working edge of the tool. These edges usually have medium edge angles and straight edge configurations in plan and side view.

13 Cutting/sawing hard material. Employable units have crushed edges made up of small step fractures. These edges usually have medium edge angles and straight edge configurations in plan and side view.

14 Cutting/sawing medium to hard material. Wear indicates use on something other than soft material, but the type of material is in question.

15 Perforating soft to medium material. Projections exhibit smoothing, rounding, or polish.

16 Drilling medium material. Projections used to drill medium material show blunting, rounding, and polishing of edges. Step fractures seldom occur. Striations are perpendicular to the long axis of the projection, and uneven beveling indicates direction of motion. Drilling projections are usually thicker than perforators. The cross-section is often diamond-shaped. Edges of the projections are bifacially worked to attain this shape.

17 Drilling hard material. Projections of employable units have configurations as those in 16, but wear includes crushing and step fractures along the sides of the projection, especially on the tip.

18 Drilling material unspecified. Wear patterns include rounding, polishing, crushing, and step fractures.

19 Scraping/planing soft material. Wear on employable units is primarily edge rounding, smoothing, or dull polishing. Striations occur if dirt or grit exists on the surface of the soft material. Wear extending onto the face of the tool will most likely be unifacial. If the unit has been retouched, wear extending onto the face will be on the flake scar surfaces as well as ridges.

20 Scraping/planing medium materials. Employable units have shallow, uniform, unifacial microflake scars. The flake scars have feather terminations. Edges are slightly rounded or smoothed.

21 Scraping/planing hard materials. Employable units have crushed and blunted edges. Step terminations are frequent on edge damage flake scars. Striations, if present, will be perpendicular to the working edge.

22 Scraping hard material - dry hide. Scraping dried hides produces very distinctive wear. The scraping edge or unit quickly becomes very rounded and polished. Wear extends onto the face in contact with the hide. Ridges of retouch flake scars become rounded and polished as well. Microflaking does not seem to occur.

23 Scraping material undetermined.

24 Chopping/pounding soft/medium materials. A variety of morphological forms can exhibit chopping or pounding wear. Experimental work (Boydston and Lurie 1984; Dodd 1979) indicates that wear is usually in the form of rounding, smoothing, and polishing rather than crushing, unless the material chopped/pounded is hard. Edge angles are steep. The whole tool will tend to be large, since weight is an important attribute in performing these activities.

25 Chopping/pounding hard material - Same tool configuration as above, but wear includes crushing, large flake scars with step termination, and faceting on surfaces.

26 Digging - "These are large core tools with an elongated flattened form manufactured by free-hand percussion to form an acutely angled working edge on at least one end. Use-wear consists of pronounced rounding and smoothing and edge perpendicular striations. Polish is sometimes present. Wear traces continue up the edge and well onto adjoining tool faces. This type of wear indicates penetration into a soft material, presumably soil, with a chopping work action motion" (Ahler 1984:35).

27 Slotting/graving/grooving - Employable units are projections, often with edges and fairly thick cross-sections. Edges, if present, are short and have medium to steep edge angles. These kinds of tools are subject to heavy attrition. The projections or edges do not become rounded, but continually resharpen themselves. Tips are crushed and have flake scars with step terminations. The sides of the projections will be rounded, blunted, or often polished.

28 Wedging - Tools used for wedging often have triangular or lenticular cross-sections and medium edge angles. Opposing edges will have crushing as a result of use: one end crushed by a hammer or billet, the other from contact with the subject material.

29 Tool backing - Employable units are often sheared edges. Wear includes smoothing or polishing as the result of contact with the hand.

30 Raw material supply - Cobbles, cobble fragments or multisided pieces without flake ventral surfaces. They exhibit at least one relatively large negative flake scar or more than four smaller negative scars (Ahler 1975a:506-508).

31 Pigment source - Employable unit, usually the surface of an iron ore is abraded and sometimes striated.

32 Practice pieces - "These tools are small and thick, unpatterned objects modified by bifacial or unifacial retouch (usually percussion) around most or all of the tool perimeter. These tools lack wear, but exhibit edge crushing and step flaking from percussion flaking. These items are hypothesized to be nonpurposely flaked stone made by idle flint knappers or to be the results of learning efforts by inexperienced knappers" (Ahler and Christenson 1983:134).

33 Other nonutilitarian items - beads, pendants, etc.

34 Abrading (a) is characterized by the presence of flat or concave surfaces. Tools may be hand-held or stationary. This distinction is made under morphological type, but since most of the midden mound materials are fragmentary, this distinction was difficult to make, and most items were categorized as ground stone fragments. The material abraded is not specified here, but if traces of material, such as hematite, were detected on surfaces, they were noted in the written comments.

35 Abrading (b) is characterized by abraded grooves on tool surfaces. These tools may have been used for shaping/sharpening wood or bone objects. Abraded grooves are often found in conjunction with abraded surfaces. Therefore, these tools were often recorded as multipurpose ground stone tools under morphology.

36 Anvilstones are characterized by pecked pits and small linear grooves. They may be hand-held of stationary. A preliminary survey of the midden mound material indicates that most were either hand-held or too fragmentary to be labeled. Both hand-held and stationary anvils are called anvils morphologically.

37 "Nutting stones" are characterized by smoothed pits on tool surfaces. These pits originally may have been pecked, but use or intentional modification have created the smooth pit.

38 Impact fractures - possible projectile.

HAFTING: The presence, possibility, or absence of a hafting element has been scored for all items. Biface hafting element morphology is most consistently used to place items into stylistic categories which may represent prehistoric "cultures" or may be sensitive time markers. Hafting element configurations may also be related to function. Some forms of notching, base shape, or edge treatment might allow the object to be imbedded and secured to a shaft or foreshaft in ways that would restrict slipping or twisting during use. This would be applicable to other technological classes as well as bifaces.

For those items with hafting elements, several qualitative and quantitative variables were recorded. HAFT TYPE records the configuration of the entire hafting element. This variable is based on the presence and location of notches. Attribute states for HAFT TYPE included lanceolate or shallow side notched, deep side notched, corner notched, stemmed, and basal notched varieties. Unusual haft configurations not listed above were scored as "other." When hafting elements were incomplete their configuration was usually scored as "can't determine."

HAFT BASE CONFIGURATION was also recorded for all hafted pieces. This variable refers to the shape of the haft element basal margin. Base configurations were characterized as convex, concave, straight, bifurcate, pointed, or rounded. HAFT SIDE OR BASE TREATMENT referred to marginal modifications of the haft element sides and/or base. The modifications, if present, are in the form of beveling, thinning or fluting, grinding, or combinations of these.

Four quantitative variables were recorded for hafting elements: HAFT NECK WIDTH, HAFT BASE WIDTH, HAFT LENGTH, and NECK ANGLE. The first three of these variables were recorded during Phase I and II. When measurements for these three variables were not available for artifacts in Phase III analysis, measurements were taken using the following Phase I definitions.

a. Neck width (juncture width) - distance on the coronal plane between junctures. The coronal plane was "the plane which includes the margin" junctures were "the paired, most distal points on the edge beginning at the most medial vertices not on the basal plane and ending at the next vertex on the margin moving initially toward the proximal end of the midline."
b. Base width - "distance on the coronal plane between ends of the base."
c. Length - "Perpendicular distance between the basal plane and the transverse plane which includes the junctures."

Johnson (1981) found that haft angle was an important variable for distinguishing among types of stemmed bifaces. He defined haft angle "the angle formed by the intersection of lines drawn to bisect the angles defined by the notches which form the haft." (p. 144) (Figure 8.27). Following Johnson's conventions if only one side of the base was present, "symmetry was assumed and the angle at which the line bisecting the one remaining notch intersects the longitudinal axis was measured and doubled to give an approximation of the haft angle." (p. 144)

To record this measurement in a standardized way, hafted tools were xeroxed and angles drawn on these outlines. The line bisecting an angle was drawn using the midpoint of the line connecting the blade shoulder (tang or barb) and the corner of the base, and the apex of the angle. Futato (personal communication 1986) has pointed out that notch angles divided in this manner will vary with shoulder width and base length and, therefore, the haft angle measurement will vary. Differences in the notch angle division will be most pronounced when variations in shoulder width and base length are great. Notch angles for a random sample of ten tools in this study were bisected with a protractor. In all cases the haft angle measured using these angles were within two degrees of the original measurements. It seems that shoulder width/base length differences do not appreciable effect haft angles in these specimens. Given that the original drawing of notch angles are somewhat subjective, these slight differences in haft angle measurements are probably not significant, and the term HAFT ANGLE will be retained for this variable.

MORPHOLOGY: Morphological classes have long been established for chipped and ground stone tools. They are usually based on a combination of formal, functional, and technological attributes. This combination of attributes makes the relationship of morphological classes to human behavior very difficult to interpret (Ahler 1984 vol. 4). In addition, these classes are seldom standardized, nor are they easy to standardize from one project or one geographical area to another (Lurie 1982). The aim in the lithic study was to separate those variables that can be linked to technological, functional, or social aspects of behavior and to treat each of these aspects as separate, yet related, factors influencing the character of lithic assemblages.

During Phase I and II, 205 morphological classes were defined - 67 kinds of projectile point/knives, 15 kinds of biface blades, eight kinds of preforms, 14 kinds of drills or perforators, 15 kinds of cores, 28 kinds of scrapers, 21 kinds of other unifacial and bifacial tools, and 37 kinds of ground stone tools. For this study, a smaller more manageable set of morphological categories were established to enable comparisons with other sites in the Tombigbee Valley which have been reported using a traditional tool typology and with Phase I and II assemblages that were not part of this study. Definitions of the original 205 morphological categories are found in Appendix I. Definitions retained for Phase III are noted below with an asterisk.

Of the 67 kinds of projectile point/knives only the Archaic point types are given their own morphological classes. These are Greenbriar/Dalton, Kirk, Big Sandy, Eva/Morrow Mountain, Cypress Creek, Sykes-White Springs, Benton, and Little Bear Creek/Flint Creek (Figures 54-56). All other named projectile point/knives were placed in a general, other group, and the type name was recorded as a written comment. The assignment of projectile point/knives to these categories was retained from Phase I and analysis unless obvious typological or computer errors were evident. In these cases, Phase I point type definitions were used for reassignment to a new morphological type.

There are two categories for finished bifaces other than projectile point/knives. The category biface with lateral working edge pertains to unhafted, refined, symmetrical bifaces that show traces of wear along the lateral margins. The category biface with transverse working edge includes hafted and unhafted biface scrapers. Bifaces with lateral working edges are often analogous to the Phase I and II category "biface blades." The distinction between biface blade shape and technology used to subdivide this category during Phase I and II was recorded under GEOMETRIC SHAPE and TECHNOLOGICAL CLASS. There is one category for preforms. From a technological perspective these represent items that seemed to be unfinished bifaces. Their degree of refinement was recorded under PRODUCTION STAGE.

There is also only one category for cores. Cores are sources of raw material. They may be cobbles, parts of cobbles, or multifacial chunks without cortex, which exhibit at least one relatively large flake scar or four or more small flake scars. The distinction between free-hand and bipolar was made under TECHNOLOGICAL CLASS. A combination category of core-hammer is also included for those cores that were modified through battering as well as flaking. This battering was distinct from any core platform preparation.

There are three classes of unifacial tools: end scrapers, side scrapers and a combination end-and-side scraper (Figure 57). These categories contain all tools that are intentionally modified on one face, not simply along an edge. The distinction between end and side was made in relation to the flake bulbar axis or the long axis of the tool if no bulbar surface exists. One category each was allotted to the following morphological types:

a. Drills - Drills are long, narrow tools that were usually bifacially worked with a diamond-shaped or triangular cross-sections. They may or may not have hafting elements.
b. Perforators/Gravers - These are artifacts that exhibit short projections. These projections are often formed by unifacial retouch although the configuration of the piece as a whole could be bifacial, unifacial, or retouched flake or chunk.
c. Burins - Burins are tools with bits formed by burin blows, blows struck approximately at right angles to a flat, relatively narrow surface.
d. Wedges - These are tools with relatively steep, transverse working edges. Opposite edges often both show battering and crushing: one end crushed by a hammer or billet, the other from contact with the subject material. Cross-section depended on the configuration of the tool as a whole. Biface cross-sections are often lenticular. Flake or chunk cross-sections are usually triangular.
e. Denticulates - are tools, usually flakes, which have repeated, contiguous notches separated by ridges along an edge or edges. These notches are larger and wider than serrations.
f. Spokeshaves - These artifacts possess one or more a steeply retouched concavities or notches. Multiple notches are not contiguous. Spokeshaves are usually made on flakes.
g. Choppers - Choppers are large tools with one or more steeply flaked working edges. Edges could be unifacial or bifacial.

All utilized and edge-retouched pieces were placed in one category in terms of morphological class, since without careful inspection of microflaking size and pattern, it was not possible to distinguish between use and retouch. For artifacts analyzed during Phase III distinctions between retouched and utilized modification, and among retouched or used flakes, bifacial thinning flakes, blades and chunks was made under TECHNOLOGICAL CLASS.

A category for other chipped stone was included in the recording scheme for any shaped artifact that did not fit into one of the above categories. A written comment was made describing any such item. The final chipped stone category was for fragments that can not be assigned to any other category. These could be sorted into bifacial, unifacial, and other fragments using the variable TECHNOLOGICAL CLASS.

Morphological categories for ground stone can be divided into two groups: shaped ground stone and use-modified only ground stone. Shaped categories included the following:

a. Pestle - These artifacts are relatively large grinding tools with a distinctive bell-shaped plan view. The grinding surfaces are at the narrow end, and the sides are smooth.
b. Axe/adze - A tool with a broad transverse bit and grooves for hafting.
c. Celt - Greenstone, highly polished tool with a lenticular cross-section and a biconvex transverse bit. The bit is usually opposite a tapered poll or butt section.

d. Atlatl weight - These are ground and polished items with a central hole to facilitate hafting. Various geometric shapes occur.
e. Bead/bead preform - These are circular, tubular or zoomorphic-shaped objects that have been ground and polished. Finished items have drilled perforations presumably for attachment.
f. Awl - Awls are slender slivers of petrified wood that have at least one pointed end that shows rounding and smoothing.
g. Drilled stone core - These are plug-shaped pieces removed from pieces of stone by drilling.
h. Other shaped ground stone - Any intentionally shaped piece of ground stone that did not fit into one of the above categories.

Ground stone items modified by use were assigned to categories based on the type of use modification. They were the following:

a. Hammerstone - Tools which have one or more localized areas of battering or crushing on edges or surfaces.
b. Anvil - Pieces of stone that have been pecked or battered to form irregular depressions, small linear grooves, or pits on a tabular surface.
c. Abrader (hand-held and stationary) - Abraders show localized areas of grinding and smoothing. Abrasion can take the form of flat or concave surfaces or grooves.
d. Ground hematite/limonite - These are pieces of iron compounds which exhibit abraded, grooved, or polished surfaces.
e. Other use-related ground stone - Any item thought to be modified by use that does not fit into one of the above categories.
f. Multi-use ground stone - The tools show more than one kind of non-flaking modification. These different modifications are recorded under tool function.

As with chipped stone, there is a category for ground stone fragments that can not be placed into any of the above categories.

Upon reexamination, some material sorted as tools during Phase I and II were scored as debitage. These items were scored as not applicable for MORPHOLOGICAL CLASS.

Metric measurements for length, width, thickness, and weight were recorded for most of the whole, formal tools during Phase I and II. During Phase III these measurements were recorded when possible for all tools except utilized flakes less than one inch in maximum dimension. Conventions established during Phase I and II were maintained. Measurements are recorded in millimeters.

For symmetrical tools LENGTH was the maximum perpendicular distance between transverse planes tangent to the tool. WIDTH was the maximum perpendicular distance between planes parallel to the longitudinal plane and tangent to paired points on the tool. THICKNESS was the maximum perpendicular distance between planes parallel to the coronal and tangent to paired points on the tool.

Tools which were not symmetrical, but did show flake morphology, were oriented with the bulbar axis. In these cases LENGTH was the maximum perpendicular distance between two planes parallel to the bulbar axis and tangent to the artifact. WIDTH was the maximum perpendicular distance between two planes parallel to the bulbar axis and tangent to the tool. THICKNESS was the maximum perpendicular distance between two planes parallel to the bulbar axis, perpendicular to the planes defining the maximum width, and tangent to the tool.

Tools without symmetry which showed no original flake blank orientation were measured according to absolute dimensions. LENGTH was the maximum perpendicular distance between two parallel planes tangent to the tool. WIDTH was the maximum perpendicular distance between two parallel planes tangent to the tool and perpendicular to the planes defining the length. THICKNESS was the perpendicular distance between two parallel planes tangent to the tool and perpendicular to both the planes defining the length and those defining the width.

Artifact weight is recorded for all items, including broken ones on which no length, width, or thickness measurements were possible. This provided at least an estimation of artifact size. Weights are recorded to the tenth of a gram.

Length, width, and thickness were not taken for utilized flakes less than one inch in maximum length. These were placed into size-grade categories recorded during Phase I and II. The two size categories were 1/2 inch and 1/4 inch.

Comments on various aspects of tool raw material, function, fracture, hafting, and morphology were necessary for some tools and these were coded by the type of comment and entered into the computer. Two of these comment types were of particular importance. First were items that were questionable artifacts. These can be eliminated from tabulation if necessary. Second, refits were coded so that the broken parts can be tabulated separately or as whole items. If refit items were recovered from the same level, one of the refit pieces was coded for use in statistical tests. This piece has whatever artifact dimensions were taken for the refit item. If refit pieces were found in different levels but within the same time category, the same distinction was made. If refits were from different time categories, each refit piece was considered a separate artifact.

SECTION 5: DATA ANALYSIS RESULTS

The analysis section of this chapter contains three parts which deal with the descriptive and explanatory questions outlined in section one. The first part addresses the question of hafted biface classification, the next part describes the lithic assemblages for all the sites studied. Particular attention will be paid to similarities and differences in technology, tool function, and tool and debitage disposal. Finally, the expectations for lithic assemblages under different mobility strategies will be examined.

HAFTED BIFACE PATTERNS AND CORRELATIONS

Classification of hafted bifaces has been approached in two ways in this study. The first has been to perform a cluster analysis using the following four continuous variables: NECK WIDTH, HAFT BASE WIDTH, HAFT LENGTH, and HAFT ANGLE. The second treats discrete variable that describe the hafting element (HAFT TYPE, HAFT BASE CONFIGURATION, and HAFT SIDE OR BASE TREATMENT) and the blade segment of the biface when it is present (CROSS SECTION, PRESSURE FLAKING OR RESHARPENING PATTERN, and FUNCTION).

A total of 401 hafted tools were included in the lithic study. Of these, 172 belong to chronologically sensitive named types described in Phase I. One hundred and twenty seven are classified "other projectile point/knives." This group includes triangular bifaces without distinct hafting elements, named types that are represented in our sample by only one or two items, and residual stemmed pieces that could not be assigned to any other named category. Sixty-seven specimens had haft element fragments too incomplete to classify further. The remaining 35 hafted specimens included the following morphological classes: biface with lateral working edges (6), drills and perforators (14), unifacial and bifacial scrapers (9), choppers (2), retouched flake (1), and "other" tools (3).

Of the 172 named specimens, 121 had all four continuous variables recorded. Measurements on haft neck, base width, and haft length are available from Phase I and II data sets. Haft angle was measured during this study as a continuous variable reflecting haft element notching position. A cluster analysis was performed on these 121 items to see if haft element measurements could produce time sensitive clusters and to identify any correspondence between these objectively formed clusters and more intuitive, named biface types. A SAS clustering procedure employing Ward's methods which minimizes the error sum of squares was used (SAS Institute, Inc. 1982:423-432). A 0.95 value for R-squared was used to determine the most useful number of clusters. The results of a nine-cluster solution are presented in Table 11 of Appendix III.

The procedure did not produce time-sensitive clusters. Only Clusters 7, 8, and 9 reflect restricted time periods: Cluster 7 the Middle Archaic 1, and Clusters 8 and 9 the Early Archaic. Clusters 4, 5, and 6 contain members primarily from the Early Archaic/Middle Archaic 1 and from the Middle Archaic 4. Clusters 1 and 3 contain items from all time categories. Cluster 1 contains members from the Middle Archaic 1 through the Late Archaic, although most are from the Middle Archaic 1.

Comparison of the clusters and traditionally hafted biface types indicates that the greatest correspondence is between Greenbriar/Dalton (lanceolate bifaces) and Clusters 8 and 9 (Table 100). All but one of the Greenbriar/Dalton bifaces occurs in these clusters, while the clusters contain only two items which have not been classified as Greenbriar/Dalton. The majority of Kirk bifaces fall into Clusters 4 and 5, but these clusters also contain 28% of the Sykes-White Springs and Benton points. Eva/Morrow Mountain, and Cypress Creek points appear primarily in Clusters 1 and 2, and in 6 and 7. While Clusters 6 and 7 have only one other member, Clusters 1 and 2 contain over 50% of the Benton points. Most of the Sykes-White Springs bifaces are found in Clusters 4 and 5, along with Bentons and Kirks. Bentons occur in six clusters (1 through 5), and Little Bear Creek bifaces occur in Clusters 2, 3, and 4.

TABLE 100
Comparison of clusters and traditionally named biface types.

		Cluster								
Type	Frequency	1	2	3	4	5	6	7	8	9
Greenbriar	9			1					4	4
Kirk	14		1	2	5	6				
Big Sandy	1								1	
Eva	13	6	2				1	4		
Morrow Mountain	18	10	1	1			3	3		
Cypress Creek	12	6	3	2			1			
Sykes-White Springs	15		1	5	5	3			1	
Benton	35	6	13	9	3	3	1			
Little Bear Creek	4		2	1	1					

The clusters appear to differentiate between shallow side notching (or lanceolate) and deep side notching (Cluster 8 and 9), and basal notching or contracting stemmed bifaces (Clusters 6 and 7), but do not separate corner-notched bifaces from other non-contracting stemmed items. There are several possible reasons for this. First, of the four continuous measurements, haft angle which reflects notching position is the most susceptible to measurement error. Second, the standardized method of measuring haft angle is particularly sensitive to variations in notching position caused by missing barbs, shoulders, or corners from bases and blades. Conventions established for recording haft angle may obscure variability that can be assessed by some other discrete, albeit more intuitive, variables. Third, the asymmetry of many of the bifaces will also effect haft angle measurement.

Since time categories were assigned to block and level units partially on the basis of supposed chronologically sensitive biface types, it was expected that these types in the sample would occur within specific time categories. Cross-tabulation of named biface types time category shows this to be the case for most of the items in the earlier time categories (Table 101). However, the other biface types are present in three or more of the time categories. Although Morrow Mountain bifaces are found primarily in the early Middle Archaic, Bentons and Little Bear Creeks in the latter part of the Middle Archaic and Late Archaic, a few of each type are present in other time periods. These may be mistyped or may represent the manufacture of named biface types over a broader period of time than expected, or they may reflect mixing of these specimens after initial deposition. Sykes-White Springs and Cypress Creek bifaces have the most even distributions over four time periods. These are the most poorly defined, most heterogeneous biface types.

TABLE 101
Cross-tabulation of traditionally named biface types and time category.

		Time Category					
Type	Frequency	Early Archaic	Middle Archaic I	Middle Archaic II	Middle Archaic III	Middle Archaic IV	Late Archaic
Greenbriar	9	8	1				
Kirk	14	14					
Big Sandy	1	1					
Eva	13		6	6			
Morrow Mountain	18		8	6	1	3	
Cypress Creek	12	2	6	2	2		
Sykes/White Springs	15		2	6	2	5	
Benton	35		1	2	5	26	1
Little Bear Creek	4			1		1	2

Discrete variables were recorded to help define the named biface types. Cross-tabulations of these variables which include haft type (Table 102), haft base configuration (Table 103), haft base and side treatment (Table 104), cross-section (Table 105), and pressure flaking and resharpening pattern (Table 106) have been used to generate the following descriptions of names types.

TABLE 102
Cross-tabulation of traditionally named biface types and haft type.

	Haft Type							
Type	Lanceolate	Deep side Notch	Corner Notch	Straight Stem	Incurvate Stem	Contracting Stem	Expanding Stem	Basal Notch
Greenbriar (n=17)	14	3						
Kirk (n=20)			18				2	
Big Sandy (n=2)		2						
Eva (n=12)			1			6		5
Morrow Mountain (n=20)				3		14		3
Cypress Creek (n=12)		1	3	2			2	2
Sykes/White Springs (n=21)		1		7			11	
Benton (n=42)			1	22	3	2	14	
Little Bear Creek (n=5)				2	1	1	1	

TABLE 103
Cross-tabulations of haft type and time category for morphological classes 1 through 16.*

		Time Category					
Type	N	Early Archaic	Middle Archaic I	Middle Archaic II	Middle Archaic III	Middle Archaic IV	Late Archaic
Lanceolate	22	17	2	1	1	1	
Deep side Notched	10	4	1				5
Corner Notched	29	19	4		1	2	3
Straight Stemmed	44		6	6	7	16	9
Incurvate Stemmed	5			2	1	2	
Contracting Stemmed	33		11	11	1	4	6
Expanding Stemmed	55	4	9	6	6	28	2
Basal Notched	9	5	1	2		1	

* Morphological classes 1 through 16 contain all hafted scrapers, drills, named and unnamed biface types.

TABLE 104

Cross-tabulations of haft configuration and base treatment by morphological base treatment.

Morphological Type	Haft Base Configuration	Base Treatment 1	2	3	4	5	6	7	8	9	10	11	12	13
Greenbriar/	concave					1			12				1	
Dalton	straight				1	1			1					
(n=19)	not applicable											1		
	can't determine													1
Kirk	convex								8					
(n=26)	concave								4					
	straight				1	1			4					
	bifurcate				1									
	not applicable						4							
	can't determine								1					2
Big Sandy	convex	1												
(n=3)	concave								1					
	straight								1					
Eva	convex	1												
(n=16)	straight	1			3	1			3		1			
	pointed	1			1									
	not applicable											2		
	rounded	2				1								
Morrow	convex	2					1		2					
Mountain	straight	6		1	1									
(n=17)	pointed	1							1					
	not applicable											2		
	rounded	3				2			1					
Cypress	convex					1			1					
Creek	straight	2			1	1			5					
(n=12)	can't determine												1	
Sykes-White	convex				1				1					
Springs	concave				1									
(n=21)	straight	4			1				10					
	not applicable								1					
	can't determine								1				1	
Benton	convex					1		1	1		1			
(n=21)	concave		1	5	1		1		3		2		1	
	straight		1	8	1	1	2	4	2		3		1	
	can't determine			1									2	
Little Bear Creek (n=9)	straight	2			1	1					1			

TABLE 104

Cross-tabulations of haft configuration and base treatment by morphological base treatment (continued).

Base Treatment:
1 = no treatment
2 = unifacial bevel
3 = bifacial bevel
4 = thinned
5 = ground only
6 = ground and unifacial bevel
7 = ground and bifacial bevel
8 = ground and thinned
9 = ground and fluted
10 = other
11 = not applicable
12 = fluted
13 = can't determine

TABLE 105

Cross-tabulations of morphological classes 1 through 9 and cross-section.

	Cross-section							
Type	Biconvex	Plano-convex	Plano-plano	Diamond	Other	Can't determine	N. A.	Total
Greenbriar	8	2	1	1		6	1	19
Kirk	4	9	5			4	4	26
Big Sandy		2			1			3
Eva	7	5	1		1	2	2	17
Morrow Mountain	9	10		1	3			23
Cypress Creek	7	2	2			1		12
Sykes-White Springs	8	5	3		1	4		21
Benton	3	10	30		1	2		46
Little Bear Creek	2	2		1				4

TABLE 106

Cross-tabulation of biface morphological class and pressure flaking or resharpening pattern.

Type	N	UF In	BF In	UN Down	BF Down	UF In+ Down	BF In+ Down	Seriation UF Down	Seriation BF Down
Greenbriar	8		4	1	1	2			
Kirk	18	1	7	4		3		1	2
Big Sandy	2	1	1						
Eva	9	2	4	1		2			
Morrow Mountain	19	4	10		1	3	1		
Cypress Creek	9	2	3	2		1	1		
Sykes-White Springs	10	1	6		1		2		
Benton	32	3	8		10	9	3		
Little Bear Creek	4	1	1	1					1

UF=Unifacial BF=Bifacial In= Inward pressure Down=Downward pressure

1. Greenbriar/Dalton bifaces have lanceolate haft elements. Bases are usually straight, thinned, and heavily ground. Blade elements are biconvex with bifacial inward pressure flaking.

2. Kirk bifaces have corner-notched base elements. Bases are thinned and ground. Base configurations may be straight, concave, or convex. Blade cross-section is usually plano-convex, but may also be plano-convex or plano-plano. Pressure flaking pattern is most frequently bifacial inward, unifacial downward, or a combination of the two. The unifacial downward pressure pattern is usually interpreted as a resharpening technique.
3. Only three Big Sandy points are included in the sample. These are deep side-notched bifaces with thinned and ground bases. Their blades are plano-convex in cross-section with inward pressure flaking pattern.
4. Eva and Morrow Mountain bifaces have contracting stemmed or basally notched haft elements. Bases are usually straight, but a great deal of variation exists in the sample. Over half of the specimens have no special base treatment. Those that do are thinned, ground, or both thinned and ground. Blade cross-section is either biconvex of plano-convex. Those designated "other" have irregular cross-sections. Pressure flaking patterns are for the most part unifacial or bifacial inward.

Hofman (1984) considers the Eva and Morrow Mountain points recovered from Spring Cave in middle Tennessee as different forms of the same multistage type, rather than two distinct, chronologically sensitive types. Items within a multistage type vary in form and function because of their position in the reduction and use-life sequences of that specific artifact group. Retipping, rebaseing, lateral resharpening, notching variability, and loss of barbs can modify Eva points to "include forms which have traditionally been classified as Morrow Mountain points." The Eva and Morrow Mountain bifaces examined in this study support this interpretation. The bifaces occur within the same time categories, have similar haft element and configuration attributes, and are manufactured in the same way. In addition to these, the Cypress Creek bifaces that are part of the midden mound assemblage may also fit into this multistage type.

5. Sykes-White Springs bifaces have expanding or straight stems with straight bases. The bases are usually thinned and ground. Cross-section is biconvex, plano-convex, or plano-plano in order of frequency. Pressure flaking pattern is most often bifacial inward.
6. Benton bifaces have expanding or straight stems. Bases are usually straight or convex with either unifacial or bifacial beveling. Cross-sections are most often plano-plano followed by unifacial inward or downward and then bifacial inward. These pressure flaking patterns most likely reflect the use phase of the biface. Blanks and newly finished pieces have unifacial or bifacial inward pressure flaking. These are the larger specimens. As these bifaces were used and edges dulled, unifacial and then bifacial downward pressure was used to rejuvenate them.

The distinction between Benton and Sykes-White Springs bifaces is somewhat problematical in the literature of the mid-South. However, Futato (1983:124) defines the Sykes-White Springs cluster represented in the Cedar Creek drainage of northwestern Alabama as "a broad continuum of corner removed and stemmed forms. The White Springs-like specimens overlap morphologically and temporally with Morrow Mountain and are probably most common in the earliest part of the cluster. The more distinctly stemmed forms, more Sykes-like, overlap morphologically and temporally with Benton material and are probably most common in the later part of the cluster." The Sykes-White Springs bifaces in our sample are distinctly stemmed, but are not usually plano-plano in cross-section nor do they exhibit beveling on the hafting element. The three specimens with plano-plano cross-section occur in time category 5, but Sykes-White Springs bifaces with biconvex and plano-convex cross-section occur in that time category also. All but two of the specimens are made from Camden chert. One is made from Fort Payne and one from quartzite.

The predominance of plano-plano cross-section, bifacial beveling on the hafting elements, and unifacial and bifacial downward pressure flaking pattern on the blades sets off the Benton and Sykes-White Springs bifaces in the sample. In addition, 30 of the Benton bifaces are made from Fort Payne chert, 13 from Camden, and two from material that can't be determined. Before time category 5, six Benton bifaces are made from Fort Payne chert, three are of Camden. During and after time category 5, 24 Benton bifaces are made from Fort Payne chert, 12 from Camden or some other raw material. The change in manufacturing techniques necessary to produce more Benton-like biface appears to occur gradually, over some period of time, on primarily local raw material. The addition of more Fort Payne chert does not signal a change in the technique of manufacture but a shift in raw material selection. The manufacture of plano-plano Benton-like bifaces requires large blanks. The switch to imported Fort Payne blanks may have been necessary, if cobbles of a suitable size could not have been obtained.

7. The small number of Little Bear Creek bifaces in the sample are variably stemmed bifaces with straight bases, but without consistent base or side treatment.

Analysis of traditionally named biface types and tool functions were made in an effort to determine any patterns (Tables 107 and 108). From this it appears that the function or functions for which hafted bifaces were used are varied and not specific to any named type. Bifaces were used to cut and saw soft, medium, and hard material. Eight of the incomplete bifaces have impact fractures indicating contact at the distal end with some hard material. These fractures are often interpreted as use as a projectile that has come in contact with bone, wood, or possibly hard ground. All of the impact fractures are large. The force required to generate them was probably considerable, but the possibility that these tools were accidentally dropped onto a hard surface and broken can not be discounted.

TABLE 107
Number of different functions recorded for traditionally named hafted biface types.

Type	N	No function	1 function	2 functions	3 functions	Recycled*
Greenbriar/ Dalton	19	9	6	4	0	0
Kirk	26	9	10	7	0	2
Big Sandy	3	0	2	1	0	0
Eva	17	6	8	3	0	1
Morrow Mountain	23	4	12	7	0	0
Cypress Creek	12	3	6	3	0	1

TABLE 107
Number of different functions recorded for traditionally named hafted biface types (continued).

Type	N	No function	1 function	2 functions	3 functions	Recycled*
Sykes-White Springs	21	13	4	4	0	1
Benton	46	17	16	13	0	3
Little Bear Creek	5	4	1	0	0	1
Other	155	99	36	14	1	5

TABLE 108
Hafted biface tool function by morphological class.

One Function Recorded Function	Number of Tools	Two Functions Recorded Functions	Number of Tools
		Morphological Class 1 - Greenbriar/Dalton	
Unidentified	2	Pot cutting soft/Pot cutting medium	1
Cutting medium	1	Pot cut soft/Pot piercing soft	1
Piercing soft	2	Pot cutting/Sawing medium and Pot drilling medium/hard	1
Drilling medium	1	Cutting soft/impact hard	1
		Morphological Class 2 - Kirk	
Pot cutting soft	2	Pot cutting soft/medium	1
Unidentified	2	Pot cutting medium/Pot piercing soft	1
Cutting medium	2	Pot cutting medium/unidentified	1
Cutting medium/ hard	1	Pot cutting soft impact hard	1
Piercing soft	3	Cutting soft/tool backing	1
		Cutting medium/piercing soft	2
		Morphological Class 3 - Big Sandy	
Unidentified	1	Cutting medium/piercing soft	1
Cutting medium/ hard	1		
		Morphological Class 4 - Eva	
Unidentified	2	Pot cutting soft/Pot cutting medium	1
Cutting medium	2	Pot cutting soft/Pot drilling medium	1
Cutting medium/ hard	1	Cutting soft/impact hard	1
Drilling medium	1		
impact hard	1		

TABLE 108

Hafted biface tool function by morphological class (continued).

One Function Recorded Function	Number of Tools	Two Functions Recorded Functions	Number of Tools
		Morphological Class 5 - Morrow Mountain	
Pot cutting/ Saw medium	1	Pot cutting soft/Pot cut/Saw medium	1
Unidentified	3	Pot cutting soft/Pot piercing soft	2
Cutting soft	1	Unidentified/unidentified	1
Cut/Saw medium	1	Cutting soft/Pot cut/Saw medium	1
Cut/Saw hard	1	Piercing soft/pot cut/Saw medium	1
Cut/Saw medium/ hard	2	Piercing soft/cutting soft	1
Drilling	1		
		Morphological Class 6 - Cypress Creek	
Pot cutting soft	1	Pot cutting soft/Pot piercing soft	1
Pot cut/ Saw medium	1	Cutting soft/Pot piercing soft	1
Unidentified	1	Cut/Saw medium/Impact hard	1
Cut/Saw medium	2		
Cut/Saw medium/ hard	1		
		Morphological Class 7 - Sykes-White Springs	
Pot cut/ Saw medium	3	Pot cutting soft/Pot piercing soft	1
Unidentified	1	Pot cut/Saw medium/Pot drilling medium/hard	2
Cut/Saw medium/ hard	1	Cutting medium/unidentified	1

Of the 327 hafted bifaces identified as some kind of projectile point/knife for the variable MORPHOLOGY, 164 had no function assigned to them. These are broken items lacking sufficient blade margins to assign even a tentative function. One hundred and one have a single function assigned; of these, 39 are whole. Fifty-seven have two functions recorded; thirty-four of these are whole. From these results, there is no indication that any named class is specifically designed for one particular function. The overall ratio of whole tools with one function to whole tools with two non-recycled functions is 1:14. There is no discernible tendency for any of the named types to have more multiple uses than other types.

Thirteen pieces have a recycled function and were considered whole. Functions include piercing soft material (1), drilling medium material (1), graving (6), scraping medium or unspecified materials (4), and scraping dry hide (1). It should be noted that many of the tools in the morphological classes of bifacial scrapers and drills are probably recycled bifaces that were originally used as projectiles or knives and saws. Diagnostic base configurations are often modified in the process of rehafting, and traces of previous functions are often obliterated by later functions.

In a further analysis of the patterning of hafting type through time, a cross-tabulation of haft types and time category was performed (Table 103). On the most general level, some haft types appear to be used as an indicator of chronology (Table 103), whether they have been assigned to a given named morphological type or not. Lanceolate or corner-notched points are found predominately in Early Archaic or early Middle Archaic context. Contracting stemmed and basally notched bifaces are most prominent in the early Middle Archaic and Middle Archaic 1. Straight stemmed and expanding stemmed bifaces are found most often during the late Middle Archaic, but they are found in fairly large numbers in other time categories as well. In these cases, haft type alone is not a very reliable indicator of chronology. Of the ten deep side-notched bifaces, half are found in Early Archaic and half in Late Archaic context. Again, other characteristics are necessary to distinguish which of the time categories is represented if a deep side-notched biface is found.

RAW MATERIAL SELECTION

Several questions about lithic raw material were posed in this study, including questions about the amounts of different kinds of materials used for tools, the quality of raw materials for tools, and the extent of chert heat treatment through time. Data from debitage and artifacts can be used to address these aspects of lithic technology. An analysis of these data was conducted, and the results are presented in Appendix III. The study indicates that chert was the primary material used for stone tools throughout the Archaic (Tables 109, 110, and 111). The non-chert material are primarily ferruginous sandstone and, during the later part of the Archaic, Tallahatta quartzite. The highest percentage of non-chert debitage is found in units from 22It576 (time categories 2 and 3) and 22It539 (time category 5). These units contain 12%, 20%, and 13% non-chert lithic materials, respectively. Overall the amount of non-chert debitage in the various assemblages increases slightly during the late Middle Archaic and Late Archaic. For example, non-chert debitage increases from 1% in the Early Archaic to 13% in the Late Archaic at 22It539.

The percent of artifacts made from non-chert materials at most sites during most time periods is greater than the percent of non-chert debitage. The debitage to tool ratio for non-chert material never exceeds two to one. It is likely that non-chert tools, such as sandstone abraders, required little manufacturing which would have produced flake debitage, and that artifacts such as quartzite bifaces were made elsewhere and brought onto these sites.

TABLE 109
Debitage summary - chert vs. non-chert.

	Chert		Non-chert		
Block	Frequency	Percent	Frequency	Percent	Total
22It539 Time Category 5					
Block A	1,360	91	136	9	1,496
Block B	2,449	87	367	13	2,816
Total	3,809	87	504	13	4,363
22It539 Time Category 4					
Block A	42,076	95	110	5	2,186
22It539 Time Category 2					
Block A	3,938	97	142	3	4,080
Block D	10,962	98	185	2	11,147
Total	14,900	98	327	2	15,227
22It539 Time Category 1					
Block D	4,571	99	78	1	4,622
22It576 Time Category 3					
Block D	4,534	80	1,147	10	5,681
22It576 Time Category 2					
Block D	471	88	61	12	532
22It576 Time Category 1					
Block D	4,379	96	203	4	4,581
22It590 Time Category 4					
Block B	1,330	96	59	4	1,389
22It590 Time Category 2					
Block AW	3,006	97	87	3	3,093
22It590 Time Category 1					
Block AW	4,284	97	116	3	4,400
Block AY	6,875	99	104	1	6,979
Block E	541	98	13	2	554
Block F	1,072	90	122	10	1,194
Block J	1,253	98	23	2	1,276
T.S. 13	328	99	3	1	331
Total	14,353	97	381	3	14,734
22It621 Time Category 2					
Block A	2,689	91	269	9	2,958
Block C					
Block E	1,323	94	91	6	1,414
Total	6,101	92	500	8	6,601
22It621 Time Category 1					
Block A	2,152	98	35	2	2,187
Block C	1,802	100	4	1	1,806
Total	3,954	99	39	1	3,993

TABLE 109
Debitage summary - chert vs. non-chert (continued).

Block	Chert Frequency	Chert Percent	Non-chert Frequency	Non-chert Percent	Total
22It623 Time Category 6					
Block D	348	95	20	5	368
22It623 Time Category 5					
Block C	673	94	44	6	717
22It624 Time Category 6					
Block A	1,071	94	74	6	1,145
Block B	949	93	74	7	1,025
Block C	589	95	33	5	622
Total	2,609	94	183	6	2,782
22It624 Time Category 5					
Block A	214	90	25	10	239

TABLE 110
Chert debitage summary by site, block, level, time category, and raw material type.

Block	Camden/Pickwick/ Tuscaloosa Frequency	Camden/Pickwick/ Tuscaloosa Percent	Ft. Payne Frequency	Ft. Payne Percent	Other Chert Frequency	Other Chert Percent	Total
2It539 Time Category 5							
Block A	1,111	82	237	18	7	1	1,355
Block B	2,103	86	346	14	1	1	2,449
Total	3,214	85	583	15	8	1	3,804
22It539 Time Category 4							
Block A	1,895	91	181	9	2	1	2,076
22It539 Time Category 2							
Block A	3,756	93	287	7	13	1	4,056
Block D	10,581	97	373	3	8	1	10,962
Total	14,337	95	660	5	21	1	15,018
22It539 Time Category 1							
Block D	4,298	94	264	6	9	1	4,571
22It576 Time Category 3							
Block D	4,322	95	182	4	30	1	4,534
22It576 Time Category 2							
Block D	455	97	16	3			471
22It576 Time Category 1							
Block D	4,359	99	20	1			4,379
22It590 Time Category 4							
Block B	1,267	95	56	4	1		1,330

TABLE 110
Chert debitage summary by site, block, level, time category, and raw material type (continued).

Block	Camden/Pickwick/ Tuscaloosa		Ft. Payne		Other Chert		Total
	Frequency	Percent	Frequency	Percent	Frequency	Percent	
22It590 Time Category 2							
Block AW	2,811	94	181	6	14	1	3,006
22It590 Time Category 1							
Block AW	3,954	92	312	7	18	1	4,284
Block AY	6,344	92	496	7	25	1	6,875
Block E	503	93	33	6	5	1	541
Block F	950	89	117	11	5	1	1,072
Block J	1,209	96	44	4	0	0	1,253
T.S. 13	317	97	10	3	0	0	328
Total	13,277	93	1,012	7	54	1	14,343
22It621 Time Category 2							
Block A	2,614	97	49	2	26	1	2,689
Block C	2,011	96	68	3	10	1	2,089
Block E	1,269	97	50	4	4	1	1,323
Total	5,894	97	167	3	40	1	6,101
22It621 Time Category 1							
Block A	1,994	97	40	2	18	1	2,052
Block C	1,756	98	23	1	23	1	1,802
Total	3,750	97	63	2	41	1	3,854
22It623 Time Category 6							
Block D	310	89	36	10	2	1	348
22It623 Time Category 5							
Block C	614	91	54	8	5	1	673
22It624 Time Category 6							
Block A	895	84	170	16	6	1	1,071
Block B	694	70	254	26	1	1	949
Block C	424	72	163	28	2	1	589
Total	2,013	77	587	23	9	1	2,609
22It624 Time Category 5							
Block A	194	92	18	8	1	1	214

TABLE 111
Artifact raw material by time category*.

Time Category	Raw Material	22It539		22It576		22It590		22It621		22It623/22It624	
		N	%	N	%	N	%	N	%	N	%
1	C/Y/P	205	82.6	369	95.8	454	77.1	173	94.5		
	FP/FFP	22	8.9	3	.8	75	12.7	5	2.7		
	O Chert	4	1.6	4	1.0	28	4.8	4	2.2		
	Non-chert	17	6.9	9	2.3	32	5.4	1	.5		
	Total	248	100	385	99.0	589	100	183	99.9		

TABLE 111
Artifact raw material by time category* (continued).

Time	Raw	22It539		22It576		22It590		22It621		22It623/22It624	
Category	Material	N	%	N	%	N	%	N	%	N	%
2	C/Y/P	382	88.9	62	81.6	104	82.5	397	85.9		
	FP/FFP	77	8.1	6	7.9	9	7.1	35	7.6		
	O Chert	17	1.8	2	2.6	5	4.0	13	2.8		
	Non-chert	19	2.0	6	7.9	8	6.3	17	3.7		
	Total	945	99.9	76	100	126	99.9	462	100		
3	C/Y/P			652	75.4						
	FP/FFP			72	8.3						
	O Chert			19	2.2						
	Non-chert			122	14.1						
	Total			865	100						
4	C/Y/P	209	67.1	9	52.9	145	70.7				
	FP/FFP	59	19.0	1	5.9	16	7.8				
	O Chert	17	5.5	0		4	2.0				
	Non-chert	26	8.4	7	41.2	40	19.5				
	Total	311	100	17**	100	205	100				
5	C/Y/P	404	55.2	24	55.8	13	76.5			216	78.5
	FP/FFP	238	32.5	16	37.2	0				26	9.5
	O Chert	13	1.8	0		0				10	3.6
	Non-chert	77	10.5	3	7.0	4	23.5			23	8.4
	Total	732	100	43**	100	17**	100			275	100
6	C/Y/P									326	54.8
	FP/FFP									186	31.3
	O Chert									17	2.8
	Non-chert									66	11.1
	Total									595	100

* Items recorded as "can't determine" not included.
** Represented by features only.
C/Y/P=Camden/Yellow Chert/Pickwick
FP/FFP=Fort Payne/Fossiliferous Fort Payne
O chert=Other chert

Chert materials can be grouped into local cherts and nonlocal cherts. Local cherts are by far the most common material present in both the debitage and tool assemblages from all sites at all time periods. "Other" chert debitage comprises only a small percentage (1% or less) of any of the lithic assemblages. In all assemblages the percentage of tools made from "Other" chert is greater than the percent of debitage. These tools, usually small bifaces or biface fragments, apparently were manufactured somewhere else. The percent of tools made from "Other" material ranges from 1% in 22It576 (time category 1) to 5.5% in 22It539 (time category 4), but there is no spatial or temporal patterning to these small variations. For example, the second highest percent (4.8%) is from 22It590 (time category 1); the second lowest percentages (1.8%) are from 22It539 (time categories 2 and 5).

Fort Payne chert comprises a relatively small part of the lithic debitage at all of the site in time categories 1, 2, and 3 (approximately 4%), and the percentage of tools is also relatively low (less than 8% overall). Most of the Fort Payne chert recovered from the earlier components is fossiliferous Fort Payne rather than the blue-gray Fort Payne found in the later components.

The amount of Fort Payne debitage increases substantially in time categories 4 and 5, 22It539 (9% and 15%, respectively) and in time category 6, 22It623/22It624 combined (21%). Fort Payne is 26% and 28% of the chert debitage in Blocks B and C at 22It623. As with the "other" nonlocal raw materials, Fort Payne contributes more substantially to the tool inventory than to the debitage. For example, while 15% of the debitage in time category 5, 22It539 is of Fort Payne chert, 32.5% of the tools are made from this material. Likewise, while 21% of the debitage in time category 6, 22It623/22It624 is Fort Payne, 31.3% of the tools are.

At 22It623/22It624 the amount of Fort Payne may be greatly exaggerated, though, because many of the Fort Payne biface fragments probably were parts of the same tool. This particular unit contains over a hundred small fragments of Fort Payne that are very similar in color, texture, and mottling. An estimated three or four broken bifaces could have produced these hundred or more pieces. The high percentage of Fort Payne chert in the feature material in time category 4, 22It576 may also represent fragments of only a few tools. These two cases not withstanding, the small amount of debitage in relation to the amount of tools at these sites supports the contention that Fort Payne biface blanks or finished tools were brought into the midden mound sites and that minimal amounts of knapping were necessary to finish, resharpen, or rework them.

It should be noted that Fort Payne debitage and tools do not increase during time period 4, 22It576 and 22It590 or in time category 5, 22It623/22It624. The introduction of this material into the Tombigbee Valley appears to vary from site to site in these later time periods.

RAW MATERIAL QUALITY

Most of the chert used by the Archaic inhabitants of these midden mound sites was of good quality. While a formal assessment of chert quality was not made during Phase I and II, an examination of the sample debitage units shows that the quality of raw material is generally good, except at Site 22It621. In the sample units from this site, flakes often have areas of spongy cortex or rough texture, even on small flakes. All artifacts included in this study were scored for raw material quality. A frequency analysis of these data revealed that, except for those units represented by feature material only, (Table 112) less than 7% of the chert is poor quality. Even fair quality chert is less than 10% at all sites, except at 22It621 and 22It623/22It624.

TABLE 112

Tool chert quality by time category*.

Time		22It539		22It576		22It590		22It621		22It623/22It624	
Category	Quality	N	%	N	%	N	%	N	%	N	%
1	Poor	9	3.8	1	.3	8	1.4	1	.8		
	Fair	13	5.5	12	3.2	50	8.8	44	36.1		
	Good	214	90.7	362	96.5	508	89.9	77	63.1		
	Total	236	100	375	100	566	100	122	100		

TABLE 112
Tool chert quality by time category* (continued).

Time Category	Quality	22It539 N	22It539 %	22It576 N	22It576 %	22It590 N	22It590 %	22It621 N	22It621 %	22It623/22It624 N	22It623/22It624 %
2	Poor	7	.8	0		3	2.4	10	3.0		
	Fair	91	9.8	2	2.8	12	9.6	106	31.5		
	Good	828	89.4	69	97.2	110	88.0	221	65.5		
	Total	926	100	71	100	125	100	337	100		
3	Poor			5	.7						
	Fair			42	5.7						
	Good			686	93.6						
	Total			733	100						
4	Poor	1	.4	4	40.0	0					
	Fair	22	8.5	2	20.0	10	6.0				
	Good	236	91.1	4	40.0	157	94.0				
	Total	259	100	10**	100	167	100				
5	Poor	6	1.0	0		1	7.1				
	Fair	30	4.8	2	4.9	2	14.3				
	Good	590	94.2	39	95.1	11	78.6				
	Total	626	100	41**	100	14**	100				
6	Poor									2	.5
	Fair									55	12.5
	Good									384	87.0
	Total									441	100

* Items scored "can't determine" not included.
** Represented by features only.

In order to compare possible changes in the quality of Fort Payne and local cherts through time, time categories 1, 2, and 3 have been designated Early Archaic, time categories 4 and 5 Middle Archaic, and time category 6 Late Archaic. Cross-tabulations of chert types and these collapsed time categories show that the amount of good quality Fort Payne chert varies little through time and variation that occurs is not directional (Table 113). The amount of good quality local chert decreases through time (Table 114).

TABLE 113
Cross-tabulation quality of Fort Payne chert by collapsed Archaic period.

Frequency Percent Row % Column %	Poor	Fair	Good	Can't Determine	Total
Early	5	14	269	15	303
	0.59	1.65	31.72	1.77	35.73
	1.65	4.62	88.78	4.95	
	71.43	58.33	35.77	23.08	

TABLE 113

Cross-tabulation quality of Fort Payne chert by collapsed Archaic period (continued).

Frequency Percent Row % Column %	Poor	Fair	Good	Can't Determine	Total
Middle	2 0.24 0.56 28.57	2 0.24 0.56 8.33	324 38.21 91.01 43.09	28 3.30 7.87 43.08	356 41.98
Late	0 0.00 0.00 0.00	8 0.94 4.23 33.33	159 18.75 84.13 21.14	22 2.59 11.64 33.85	189 22.29
Total	7 0.83	24 2.83	752 88.68	65 7.67	848 100.00

Chi-Square 23.062 with 6 DF Prob = .001

TABLE 114

Cross-tabulation quality of local material by collapsed Archaic period.

Frequency Percent Row % Column %	Poor	Fair	Good	Can't Determine	Total
Early	22 0.48 0.68 64.71	339 7.38 10.43 71.22	2,682 58.37 82.55 72.68	200 4.35 6.16 51.68	3,243 70.71
Middle	11 0.24 1.08 32.35	99 2.15 9.71 20.80	798 17.37 78.24 21.63	110 2.39 10.78 28.42	1,018 22.20
Late	1 0.02 0.31 2.94	38 0.83 11.66 7.98	210 4.57 64.42 5.69	77 1.68 23.62 19.90	326 7.09
Total	34 0.74	476 10.36	3,690 80.30	387 8.42	4,587 100.00

Chi-Square 132.964 with 8 DF Prob = .000

Although chi-square statistics show that non-random changes in chert quality have probably occurred in the use of both these materials, the changes are due in large measure to the amount of chert for which quality could not be determined. Quality of smaller pieces of chert and those that were heat altered are difficult to assess, and in the Late Archaic period the mean artifact size decreases and the amount of heat alteration increases. Since mean artifact sizes decreases and the amount of heat alteration increases in the Late Archaic, a higher percent of specimens were scored "can't determine" for this variable.

HEAT TREATMENT AND HEAT ALTERATION

During Phase I and II the presence or absence of heat treatment was recorded for Camden and Tuscaloosa or Yellow chert. In the sample units selected for this study, Tuscaloosa chert debitage was found primarily in 22It576. Small amounts are present in 22It539 and 22It621, and to an even lesser extent in 22It590 and 22It623/22It624 (Table 115). In most cases the ratio of heated to non-heated Tuscaloosa is less than 1:1 (Table 116). Heat treatment of this material seems to have been of moderate importance. The ratios of heated to unheated Camden chert shows considerable variation among the size categories and with one exception (22It576, time category 1), the ratios increase as the size of the debitage category decreases. This seems to indicate that heat treatment occurred after artifacts had been roughly shaped and larger flakes and chunks of material removed. It is possible, however, that evidence of heat treatment at the earliest stages of manufacture can be found in the "fire-cracked chert" Introduced Rock category which was not included in this study. Until this category of material is included, only a tentative assessment of the stage at which heating took place can be made. Given the information available, there appears to be no clear pattern in the ratio of heated and unheated Camden through time, but the highest ratios are in the earlier time categories.

TABLE 115
Heated and unheated Camden and Tuscaloosa chert by size, site, and time category.

	Camden						Tuscaloosa					
	1 "		1/2 "		1/4 "		1 "		1/2 "		1/4 "	
Block	H	U	H	U	H	U	H	U	H	U	H	U
22It539												
T. C. 1	3	9	440	201	2,956	652	0	0	0	0	7	1
T. C. 2	34	25	1,649	605	9,492	2,328	0	1	3	5	35	18
T. C. 4	1	3	198	87	1,378	280	0	1	1	6	7	37
T. C. 5	10	17	381	178	1,868	646	0	0	3	13	36	65
22It576												
T. C. 1	14	3	479	124	2,636	423	0	5	16	95	96	465
T. C. 2	0	0	27	18	300	89	0	0	2	3	17	19
T. C. 3	9	9	520	252	2,493	971	0	2	14	34	126	184
22It590												
T. C. 1	29	40	1,371	767	8,235	2,914	0	0	0	0	6	4
T. C. 2	5	20	366	215	1,589	601	0	0	0	1	0	7
T. C. 4	2	6	107	67	826	241	0	0	0	0	0	0
22It621												
T. C. 1	9	4	408	146	2,478	659	0	0	0	2	0	4
T. C. 2	3	20	533	459	3,345	1,417	0	1	0	2	5	24

TABLE 115
Heated and unheated Camden and Tuscaloosa chert by size, site, and time category (continued).

	Camden						Tuscaloosa					
	1 "		1/2 "		1/4 "		1 "		1/2 "		1/4 "	
Block	H	U	H	U	H	U	H	U	H	U	H	U
22It623												
T. C. 5	0	1	71	22	410	105	0	0	0	0	1	0
T. C. 6	0	1	12	7	241	47	0	0	0	0	0	0
22It624												
T. C. 5	0	1	28	14	98	46	0	0	0	0	0	0
T. C. 6	4	6	203	77	1,342	352	0	0	0	0	7	7

H=Heated U=Unheated T.C.=Time category

TABLE 116
Ratio of heated to unheated Tuscaloosa and Camden debitage by site, time category, and size.

			Size		
Material Type	Site	Time Category	1 inch	1/2 inch	1/4 inch
Tuscaloosa	22It539	1			7.00
		2		.60	1.90
		4		.16	.19
		5		.23	.53
	22It576	1		.16	.21
		2		.66	.89
		3		.41	.68
Camden	22It539	1	.33	2.18	4.53
		2	1.52	2.72	4.07
		4	.33	2.27	4.92
		5	.58	2.15	2.89
	22It576	1	4.60	3.86	6.23
		2		1.50	3.37
		3	1.00	2.06	2.56
	22It590	1	.73	1.79	2.83
		2	.25	1.70	2.60
		4	.33	1.59	3.42
	22It621	1	2.25	2.79	3.76
		2	.16	1.38	2.31
	22It623	5		3.22	3.90
		6		1.70	5.12
	22It624	5		2.00	2.13
		6	.66	2.63	3.80

Heat treatment was recorded for all tools examined during Phase III (Table 117). The methods for scoring this variable provides a conservative estimate of intentional heating of chert raw material (see Section IV). It appears that heat treatment decreases considerably during time categories 5 and 6 when the use of Fort Payne chert for tools increases. In the experimental work, blue mottled, dark gray Fort Payne did not react favorably to heat, and an estimated 50% of the artifacts in these time categories are made from this raw material. It is unlikely that this material was intentionally heated. Luster contrast was used to score heat treatment on lighter varieties of blue-gray Fort Payne. Few of these pieces appear to be heat treated. This lighter material may not require heating to improve workability (Kalin personal communication 1986) or may have been heated and shaped to a stage in which luster contrast would not be evident before being brought to the sites.

TABLE 117
Artifact heat treatment by time category*.

Time	Heat	22It539		22It576		22It590		22It621		22It623/22It624	
Category	Treatment	N	%	N	%	N	%	N	%	N	%
1	Present	142	61.7	246	65.2	349	63.2	139	76.3		
	Absent	88	38.3	131	34.7	203	36.8	43	23.6		
	Total	230	100	377	99.9	552	100	182	100		
2	Present	540	58.3	42	60.9	78	65.5	287	63.6		
	Absent	387	41.7	27	39.1	41	34.5	164	36.4		
	Total	927	100	69	100	119	100	451	100		
3	Present			526	71.0						
	Absent			214	29.0						
	Total			740	100						
4	Present	198	69.7	6	60.0	92	55.4				
	Absent	86	30.3	4	40.0	74	44.6				
	Total	284	100	10**	100	166	100				
5	Present	322	50.5	15	37.5	7	50.0			124	48.5
	Absent	326	49.5	25	62.5	7	50.0			132	51.5
	Total	658	100	40**	100	14**	100			256	100
6	Present									236	45.6
	Absent									292	54.4
	Total									518	100

* Chert only; items scored "can't determine" not included.
** Represented by features only.

Although an attempt was made to determine the stage of production in which heat treatment was accomplished, most items had to be scored as "can't determine" for this variable. Only 190 heat-treated pieces could be scored for time of occurrence. Almost all of the pieces are from the early time categories (Early Archaic, Middle Archaic 1, and Middle Archaic 2). Of these 12.6% were heated in the cobble stage, 68.9% were heated in the flake blank stage, and 18.4% were heated in the unfinished biface stage. These data indicate that heating took place early, but in general not at the earliest stages of cobble reduction.

Heat alteration of chert applies to those pieces with indications of heating, but which have not been selected for further reduction. The implication is that these pieces were not intentionally heated. Analysis has indicated that the percent of heat alteration is fairly consistent through time, but it varies from 11-30% at different sites (Table 118). Heat alteration is lowest in frequency (10-13%) during the earlier time categories in 22It590 and 22It621, and in 22It576 during time category 3. The greatest amount of heat alteration occurs in 22It623/22It624 during the Late Archaic (32%). There is a shift in the manufacturing stage at which this alteration takes place. During the later time categories (4, 5, and 6) more heat alteration appears on finished tools and is most likely the result of unintentional heating. The slight increase in heat alteration coincides with the increase in Fort Payne chert at 22It623/22It624.

In summary, the great majority of debitage and tools in this study are varieties of chert. Ferruginous sandstone tools required little manufacture, they are generally tools be virtue of being used. Quartzite tools were probably made elsewhere and brought to the midden mound sites. The chert is predominantly local material derived from Tuscaloosa gravels. "Other" chert artifacts, like quartzite tools, were probably made off site. The presence of Fort Payne chert increases at some sites during the late Middle Archaic and Late Archaic. This increase probably represents the importation of biface blanks or finished tools into the midden mound area.

While the quality of all chert is generally high, the quality of local cherts decreases during the Late Archaic. This decrease in quality of local cherts corresponds to the increase in the amount of Fort Payne chert brought into the area. Heat treatment, the intentional heating of raw material, decreases through time. Heat treatment ranges from a high of over 76% in time category 1, 22It621 to a low of 37.5% in time category 5, 22It576. Although most cherts are good quality, experimental work has indicated that heat treatment probably makes local cherts easier to knap and perhaps more esthetically pleasing. Heat treatment seems to occur after bifaces or cores have been roughly shaped. Heat alteration, the unintentional heating of chert increases in the Late Archaic. Both the decrease in heat treatment and the increase in heat alteration may reflect the poor tolerance of Fort Payne chert to heat. Since heat alteration in the later time periods occurs primarily on finished tools, it may reflect longer occupation, and therefore, greater chances for unintentional heating, at certain sites.

TABLE 118
Artifact heat alteration by time category*.

Time	Heat	22It539		22It576		22It590		22It621		22It623/22It624	
Category	Alteration	N	%	N	%	N	%	N	%	N	%
1	Absent	176	74.3	292	75.4	517	87.2	164	89.6		
	Present										
	Cob-core	1	.4	3	.8	3	.5	0			
	F.B.	0		8	2.1	10	1.7	0			
	Biface	1	.4	3	.8	11	1.9	3	1.6		
	Finished	2	.8	6	1.5	12	2.0	14	7.7		
	C.D.	57	24.0	75	19.4	40	6.7	2	1.1		
	Total	237	99.9	387	100	593	100	183	100		

TABLE 118

Artifact heat alteration by time category* (continued).

Time	Heat	22It539		22It576		22It590		22It621		22It623/22It624	
Category	Alteration	N	%	N	%	N	%	N	%	N	%
2	Absent	757	72.7	57	76.0	112	86.2	405	87.7		
	Present										
	Cob-core	8	.8	0		0		0			
	F.B.	7	.8	1	1.3	3	2.3	2	.4		
	Biface	11	1.0	3	4.0	2	1.5	4	.9		
	Finished	19	1.8	1	1.3	2	1.5	39	8.4		
	C.D.	239	23.9	13	17.3	11	8.5	12	2.6		
	Total	1,041	100	75	99.9	130	100	462	100		
3	Absent			751	87.5						
	Present										
	Cob-core			4	.5						
	F.B.			3	.3						
	Biface			15	1.7						
	Finished			33	3.8						
	C.D.			52	3.8						
	Total			858	99.9						
4	Absent	229	74.1	13	76.5	162	78.2				
	Present										
	Cob-core	0		0		0					
	F.B.	2	.6	0		0					
	Biface	10	3.2	1	5.9	5	2.4				
	Finished	34	11.0	1	5.9	11	5.3				
	C.D.	34	11.0	2	3.8	9	14.0				
	Total	309	99.9	17**	100	207	99.9				
5	Absent	556	77.0	24	60.0	14	82.3			201	73.6
	Present										
	Cob-core	1	.1	0		0				1	.4
	F.B.	5	.7	0		0				0	
	Biface	14	1.9	2	5.0	0				5	1.8
	Finished	73	10.1	4	10.0	0				3	1.0
	C.D.	74	10.2	10	25.0	3	17.6			63	23.1
	Total	723	100	40**	100	17**	99.9			273	99.9
6	Absent									403	68.3
	Present										
	Cob-core									3	.5
	F.B.									2	.3
	Biface									36	6.1
	Finished									65	11.0
	C.D.									81	13.7
	Total									590	99.9

* Chert only; items scored "can't determine" not included.

** Represented by features only.

F.B.=Flake blank C.D.=Can't determine

TECHNOLOGICAL CLASS

The recording of technological variables was designed to separate manufacturing use and stylistic aspects of stone tool technology. Attributes of the variable TECHNOLOGICAL CLASS identify basic lines of tool manufacture and provide a measure for the amount of energy invested in tool production. For example, the manufacture of a biface requires more work than the manufacture of a unifacial tool, which in turn requires more work than retouched or utilized flakes. Shaped ground stone requires more time and energy to make than use-modified ground stone. Although the form of hafted bifaces changes throughout the Archaic stage, it is not certain that the underlying methods for tool manufacture have changed. In the midden mound assemblages as a whole, cores and tools representing both bipolar, to a small extent, and free hard and soft hammer reduction methods are present, as are tools requiring all levels of time and energy investment.

One way to compare the use of the methods of manufacture is to construct a measure which will take into account both the number of different technological categories of tools present in an assemblage (diversity), and the distribution of these categories within an assemblage (equitability). The Shannon-Wiener index assesses both of these characteristics (Amick 1984; Pielou 1975). Diversity indices have been calculated for each analytical unit in the study (Table 119) and scores for diversity (H) and equitability or evenness (J) plotted (Figure 48) In constructing these indices both chipped stone and ground stone attribute categories have been included, but categories for debitage have been eliminated. Both diversity and evenness of assemblages varies for units in our study, but there is no consistent pattern either for one site at different time periods or for different time categories. This is one indication that site types are not consistent either through time or across the landscape at any one particular time.

TABLE 119
Diversity indices for technological class by site and time category.

Site	Time Category	Number of Types Present	Maximum Diversity (H max)	Evenness (J')	Diversity (H')
22It529	1	15	1.1761	.8557	1.0065
	2	19	1.2989	.8098	1.0519
	4	18	1.2553	.7822	.9820
	5	19	1.2989	.7673	.9967
22It576	1	16	1.2041	.8017	.9654
	2	14	1.1461	.8803	1.0090
	3	19	1.2989	.8156	1.0594
	4*	10	1.0000	.9471	.9471
	5*	11	1.0414	.8551	.8906
22It590	1	19	1.2989	.8193	1.0562
	2	19	1.2989	.9831	1.1277
	4	14	1.1461	.8846	1.0139
	5*	8	.9031	.8866	.8007

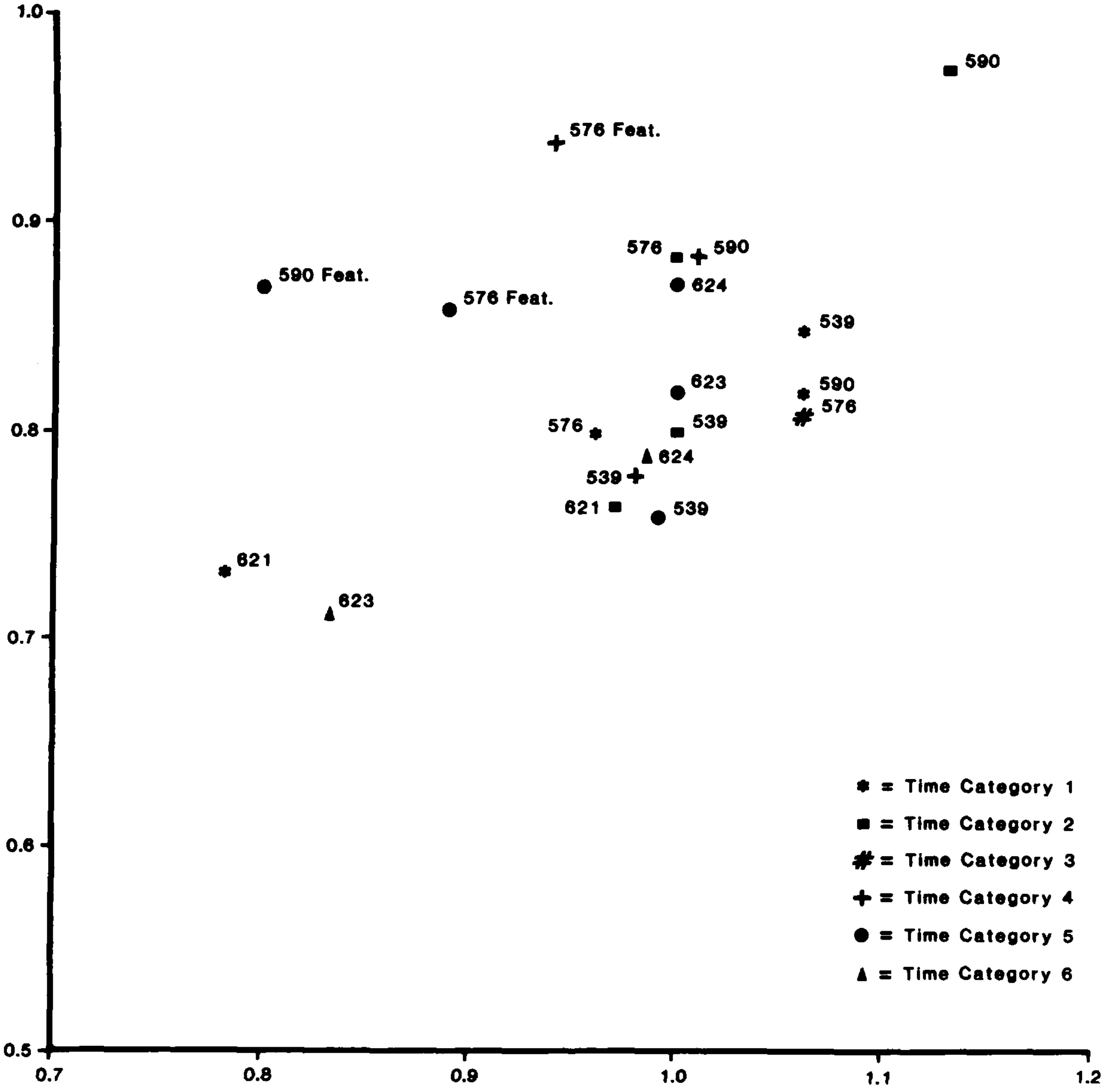


Figure 48 Diversity and evenness graph for lithic technological class and time category.

TABLE 119
Diversity indices for technological class by site and time category (continued).

Site	Time Category	Number of Types Present	Maximum Diversity (H max)	Evenness (J')	Diversity (H')
22It621	1	12	1.0760	.7323	.7880
	2	18	1.2553	.7765	.9774
22It623	5	17	1.2305	.8327	1.0247
	6	15	1.1760	.7136	.8393
22It624	5	14	1.1461	.8756	1.0036
	6	18	1.2553	.7922	.9945

* These time categories are represented by features only.
$H'' = \quad p_i \log p_i, p=(i=1, \ldots s)$
$H \max = \log s$
$J' - H'/H \max$
where, s = number of types present
H' = Index of type diversity (information content)
H max = Maximum possible diversity with given s.
J' = Evenness or equitability of specimens among types

Although there is no clear dividing line among the units in the center of the graph (Figure 48), for comparative purposes the space was partitioned into cells of low, medium, and high diversity and equitability. Units with high diversity and high equitability can be thought of as all-purpose, intensive occupations (22It590 time category 1, 22It590 time category 2). Units with low diversity and equitability can be thought of as sporadic, specialized occupations (22It621 time category 1, 22It623 time category 6). The units in the low diversity, high equitability cell, in this case represented by features at 22It590 time category 5 and 22It576 time category 5, may represent intensive procurement or maintenance activities. These features may represent cleanup activity from a limited set of activities. Those units in the middle cells represent occupation with intermediate characteristics and more generalized occupation of medium intensity.

To get an estimate of the amount of energy invested in tool manufacture as well as evaluate manufacturing techniques during different time periods and at different sites, several categories of chipped stone were collapsed, and ground stone items were dichotomized into use-modified and shaped. An analysis of the information from these collapsed categories (Tables 120 and 121) shows that ground stone tools, usually abraders and hammers, make up a relatively small part of the assemblages. Most of the ground stone recovered are fragments with areas of grinding or smoothing. It is usually not possible to tell if these fragments were once part of a shaped item or a fragment of stone modified through use only. When this distinction can be made, use-modified ground stone is the most common. Shaped ground stone items are rare in all assemblages. Shaped ground stone tools and ornaments can require considerable time to manufacture when compared to chipped stone tools, and in some areas of the Midwest these tools seen to proliferate when a sedentary lifestyle increases (Lurie 1982). Four of the study units contain 60 or more pieces of ground stone, and five units contain five or more shaped pieces. None of these units are from the Early Archaic. A total of 12 shaped tools were recovered from the earlier time categories (1, 2, and 3), while 20 were recovered from the later ones (4, 5, and 6). Based on this slim evidence, it does not appear that a great deal of energy went into ground stone artifact manufacture, although more ground stone was used in the later time periods.

The collapsed chipped stone categories included:

1. Utilized flakes/chunks - this category contains all pieces, flakes, blades, or chunks that are not retouched but used.
2. Retouched tools - this category contains all flakes, blades, or chunks that have been retouched on an edge of edges but not up on the faces of the tool.
3. Bifacial reduction flakes - this category contains all flakes or blades with bifacial platforms or complex dorsal flake scar patterns that have been retouched on an edge or used as a tool.
4. Bifaces - this category contains all bifaces.

TABLE 120
Chipped stone artifact form by time category*.

		22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Form	N	%	N	%	N	%	N	%	N	%
1	Utilized flake/chunk	56	26.2	97	27.3	89	17.9	63	17.9		
	Edge retouch only	27	12.6	56	15.8	88	17.7	5	3.8		
	Biface reduction flake	61	28.5	92	25.9	58	11.7	17	12.9		
	Uniface	4	1.9	6	1.7	14	2.8	4	3.0		
	Biface	56	26.2	74	20.9	165	33.2	36	27.1		
	Non-bipolar core	3	1.4	4	1.1	7	1.4	2	1.5		
	Bipolar core/tool	0		1	.3	3	.6	0			
	Unidentified fragments	7	3.3	25	7.0	73	14.7	6	4.5		
	Total	214	100	355	100	497	100	133	100		
2	Utilized flake/chunk	206	22.9	11	17.7	14	12.4	125	33.7		
	Edge retouch only	151	16.7	5	8.1	21	18.6	46	12.4		
	Biface reduction flake	198	21.9	9	14.5	19	16.8	21	5.7		
	Uniface	23	2.5	0		7	6.2	14	3.8		
	Biface	267	29.5	21	33.9	37	32.7	126	34.0		
	Non-bipolar core	15	1.7	1	1.6	3	2.7	11	3.0		
	Bipolar core/tool	1	.6	0		2	2.7	0			
	Unidentified fragments	43	4.8	15	24.2	10	8.9	28	7.5		
	Total	904	100	62	100	133	100	371	100		

TABLE 120

Chipped stone artifact form by time category* (continued).

		22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Form	N	%	N	%	N	%	N	%	N	%
3	Utilized flake/chunk			156	22.2						
	Edge retouch only			89	12.7						
	Biface reduction flake			92	13.1						
	Uniface			5	.7						
	Biface			262	37.3						
	Non-bipolar core			15	2.1						
	Bipolar core/tool			2	.3						
	Unidentified fragments			81	1.5						
	Total			702	99.9						
4	Utilized flake/chunk	42	15.1	1	9.1	25	16.0				
	Edge retouch only	11	3.9	4	36.4	17	10.9				
	Biface reduction flake	35	12.5	1	9.1	17	10.9				
	Uniface	5	1.8	0		0					
	Biface	160	57.3	4	36.4	74	47.4				
	Non-bipolar core	5	1.8	0		0					
	Bipolar core/tool	0		0		0					
	Unidentified fragments	21	7.5	1	9.1	22	14.1				
	Total	279	100	11**	100	156	100				
5	Utilized flake/chunk	81	12.5	5	12.5	0				61	28.4
	Edge retouch only	39	6.0	2	5.0	1	7.7			15	7.0
	Biface reduction flake	63	9.8	4	10.0	0				23	10.7
	Uniface	7	1.1	0		0				9	4.2
	Biface	389	60.2	18	45.0	4	30.8			81	37.7
	Non-bipolar core	15	2.3	1	2.5	2	15.4			5	2.3
	Bipolar core/tool	3	.5	0		0					
	Unidentified fragments	49	7.6	10	25.0	6	46.2			21	9.8
	Total	646	100	40**	100	13**	100			215	100

TABLE 120
Chipped stone artifact form by time category* (continued).

		22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Form	N	%	N	%	N	%	N	%	N	%
6	Utilized flake/chunk									81	16.3
	Edge retouch only									27	5.4
	Biface reduction flake									84	16.9
	Uniface									3	.6
	Biface									248	50.0
	Non-bipolar core									6	1.1
	Bipolar core/tool									2	.4
	Unidentified fragments									45	9.1
	Total									496	99.9

* Items scored as chipped stone debitage are not included.
** Represented by features only.

TABLE 121
Ground stone artifacts by time category.

	Ground	22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Stone	N	%	N	%	N	%	N	%	N	%
1	Use modified	3	33.3	4	44.4	27	84.4	0			
	Shaped	0		0		0		0			
	Unidentified fragments	6	66.7	5	55.6	5	15.6	0			
	Total	9	100	9	100	32	100	0			
2	Use modified	37	42.5	3	60.0	6	75.0	8	57.1		
	Shaped	7	8.1	0		1	12.5	1	7.1		
	Unidentified fragments	43	49.4	2	40.0	1	12.5	5	35.7		
	Total	87	100	5	100	8	100	14	99.9		
3	Use modified			72	66.1						
	Shaped			3	2.8						
	Unidentified fragments			34	31.2						
	Total			109	100						
4	Use modified	8	32.0	2	33.3	15	36.6				
	Shaped	1	4.0	2	33.3	0					
	Unidentified fragments	16	64.0	2	33.3	26	63.4				
	Total	25	100	6*	99.9	41	100				

TABLE 121
Ground stone artifacts by time category (continued).

T. C.	Ground Stone	22It539		22It576		22It590		22It621		22It623/22It624	
		N	%	N	%	N	%	N	%	N	%
5	Use modified	32	43.2	1	33.3	3	75.0			15	65.2
	Shaped	7	9.5	0		0				5	21.7
	Unidentified fragments	35	47.3	2	66.7	1	25.0			3	13.1
	Total	74	100	3*	100	4*	100			23	100
6	Use modified									43	71.7
	Shaped									5	8.3
	Unidentified fragments									12	2.0
	Total									60	99.9

* Represented by features only.

An examination of these categories indicates that, on the whole, technology was geared toward biface reduction. Bipolar manufacture was never an important method of producing at the sites under consideration. Formal unifacial tools are also relatively rare, about 3% of the assemblages when they are present at all. Often even utilized or retouched flakes are the by-products of bifacial manufacture. In general, a lot of energy is devoted to the manufacture of chipped stone tools.

Although the production of bifaces can be a time-consuming occupation, and although there are concentrations of lithic debitage at these sites, the variable PRODUCTION STAGE shows that most (over 80%) of the tools in the study units are finished (Table 122).

Although all stages of manufacture are present in study units except for those represented by feature material only, early stages of manufacture may have occurred off site. The predominance of small size debitage (1/4 inch or less) lends credence to this explanation. Alternatively, knappers may have been less skillful, and the number of knapping failures small. The best evidence for on-site tool manufacture comes from Early Archaic and Middle Archaic I occupations at 22It576, 22It590, and 22It621. In these units unfinished tools make up between 15% and 19% of the assemblages. Knapping concentrations of debitage and unfinished broken bifaces have been recovered from Early Archaic 1, 22It576 (see below).

In general, lithic manufacturing methods, as opposed to stylistic elements remains consistent during most of the Archaic. Bifaces are the primary type of shaped chipped tool, and the manufacture of these bifaces could easily have provided flake blakes for the few unifacial tools, retouched flakes and utilized flakes in the assemblages. Ground stone tools are primarily unshaped, utilized pieces. Tools representing most attributes states of TECHNOLOGICAL CLASS are represented at all sites in all time periods. Differences among components are more likely due to difference in site function, and therefore, the selection of specific tool from the available repertoire than to any basic change in the ways tools are manufactured.

Other analyses of lithic materials from regions adjacent to the study area, have shown that there is an increase in manufacture of narrow-bladed bifaces during the Late Archaic (Ensor 1982, Futato 1980). An informal evaluation of hafted bifaces in the Phase I and II lithic type collection indicates that a similar shift occurs here, but that the number of narrow-bladed bifaces included in Phase III was very limited. These bifaces were most often recovered in mixed context. Although the shift to narrow-bladed bifaces undoubtably occurred at these midden mound sites, the extent and timing of this technological change is at present unclear.

TABLE 122

Artifact production stage by time category*.

	Production	22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Stage	N	%	N	%	N	%	N	%	N	%
1	Cob/core	3	1.8	0		9	2.1	3	2.8		
	Biface 1	1	.6	11	3.5	18	4.2	7	6.4		
	Biface 2	4	2.3	20	6.4	28	6.5	5	4.6		
	Biface 3	3	1.8	5	1.6	15	3.5	1	.9		
	Finished	160	93.5	276	88.5	360	83.7	93	85.3		
	Total	171	100	312	100	430	100	109	100		
2	Cob/core	19	2.4	2	4.3	4	4.0	10	3.2		
	Biface 1	14	1.8	1	2.1	3	3.0	8	2.5		
	Biface 2	19	2.5	5	10.6	7	6.9	22	7.0		
	Biface 3	8	1.0	1	2.0	5	5.0	2	.6		
	Finished	705	92.2	38	81.0	82	81.1	273	86.6		
	Total	765	99.9	47	100	101	100	315	99.9		
3	Cob/core			4	.6						
	Biface 1			16	2.4						
	Biface 2			22	3.4						
	Biface 3			14	2.2						
	Finished			590	91.3						
	Total			646	99.9						
4	Cob/core	5	2.2	0		3	2.1				
	Biface 1	3	1.3	0		4	2.8				
	Biface 2	8	3.5	1	7.7	6	4.3				
	Biface 3	5	2.2	1	7.7	5	3.5				
	Finished	105	90.7	11	84.6	123	87.2				
	Total	226	99.9	13**	100	205	99.9				
5	Cob/core	16	3.2	1	3.3	0				3	2.1
	Biface 1	4	.8	0		0				3	2.1
	Biface 2	13	2.6	1	3.3	1	10.0			1	.7
	Biface 3	18	3.6	4	13.3	0				4	2.8
	Finished	452	89.9	24	80.0	9	90.0			130	92.3
	Total	503	100	30**	99.9	10**	100			141	100
6	Cob/core									5	1.1
	Biface 1									6	1.3
	Biface 2									6	1.3
	Biface 3									13	2.9
	Finished									417	93.3
	Total									447	99.9

* Items scored as "can't determine" not included.

** Represented by features only.

TOOL FUNCTION

The assessment of tool function was undertaken to evaluate intensity and variety of tool use. Tool function here is used synonomously with tool use which is identified most often by traces of use-wear. These qualitites are reflected both in the number of different functions that are performed with the same tool and the total number of different functions performed with tools at any site during a particular time period. The number of tool functions represented on any one tool presents a mixed bag of information (Table 123). Sites with midden as well as feature material in units from later time categories (4, 5, and 6) have a fairly homogenous range of function types per tool. Percentages of tools with no functions assigned range from 36% at 22It623/22It624 to 46% at 22It590. Tools with one function range from 39-45%. Those with two functions range from 7-10%. Those the three functions range from 1-4%. Multipurpose tools, therefore, appear to be scarce. Recycling is 4-5% in all these units except at 22It539 during time category 5. Eight percent of the tools here were recycled.

TABLE 123
Number of tool functions by site and time category.

	Number of	22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Functions	N	%	N	%	N	%	N	%	N	%
1	no function	75	30.1	126	31.9	255	41.2	80	44.0		
	1 function	90	36.1	167	42.3	254	41.0	73	40.1		
	2 functions	64	25.7	68	17.2	79	12.8	22	12.1		
	3 functions	10	4.0	17	4.3	8	1.3	4	2.2		
	recycled functions	10	4.0	17	4.3	23	3.7	3	1.6		
	Total	249	99.9	395	100	619	100	182	100		
2	no function	326	28.4	39	52.0	55	39.3	169	36.5		
	1 function	391	34.1	23	30.7	56	40.0	222	47.9		
	2 functions	295	25.7	7	9.3	15	10.7	51	11.0		
	3 functions	52	4.5	4	5.3	4	2.9	11	2.4		
	recycled functions	84	7.3	2	2.7	10	7.1	10	2.2		
	Total	1,148	100	75	100	140	100	463	100		
3	no function			313	34.4						
	1 function			477	52.4						
	2 functions			70	7.7						
	3 functions			6	.7						
	recycled functions			44	4.8						
	Total			910	100						
4	no function	136	40.0	4	18.2	102	46.4				
	1 function	132	38.8	13	59.1	88	40.0				
	2 functions	34	10.0	5	22.7	15	6.8				
	3 functions	8	2.4	0		4	1.8				
	recycled functions	44	4.8	0		11	5.0				
	Total	340	100	22	100	220	100				

TABLE 123
Number of tool functions by site and time category (continued).

	Number of	22It539		22It576		22It590		22It621		22It623/22It624	
T. C.	Functions	N	%	N	%	N	%	N	%	N	%
5	no function	325	40.2	24	53.3	12	57.1			92	36.4
	1 function	341	42.2	19	42.2	7	33.3			114	45.1
	2 functions	69	8.5	2	4.4	0				25	9.9
	3 functions	9	1.1	0		0				9	3.6
	recycled functions	65	8.0	0		2				13	5.1
	Total	809	100	45	99.9	21	100			253	100
6	no function									268	43.2
	1 function									253	40.7
	2 functions									63	10.1
	3 functions									13	2.1
	recycled functions									24	3.9
	Total									621	100

During the earlier time categories (1, 2, and 3) there was a wide range of different functions for tools. The percentage of tools with no functions assigned ranges from 28-52%; for tools with one function from 31-48%; for tools with two functions from 9-26%; and for tools with three functions from 1-5%. Tools with recycled functions range from 2-7%. 22It576 time category 2 is the most anomalous unit. It has the highest percent of tools with no function assigned and the lowest with one and two functions assigned. These extremes may be due to the small sample size - only 75 tools were examined - or as suggested elesewhere, an important activity at the site may have been tool manufacture. Unfinished tools or tools broken during production would be less likely to exhibit use-wear. 22It576 time category 3 and 22It621 time category 2 appear to have the most expediently used tools. They have the highest percentages of tools with only one function. 22It539 time categories 1 and 2 have the most intensively used tools. They have the fewest tools with no function recorded and the most with two and three functions. 22It576 time category 1 is similar to these last two units while units from 22It590 and 22It621 time category 1 are intermediate to extremes of expedient or more intensive tool use.

Table 124 presents the potential uses based on assessment of wear patterns for each provenience unit in this study. It reveals that the numbers of tools with potential functions are very few except for 22It590 time category 1, 22It576 time category 3, and 22It539 time categories 2 and 5. The absolute number of tools with potential functions depends primarily on the number of whole or almost whole tools in the unit. The most common potential function is cutting or sawing medium to hard material. These tools often have another potential function: drilling or graving a medium to hard substance. Cutting and piercing soft material are next in frequency for potential use. Seventeen tools have edges appropriate for use as tool backing. A few have a scraping or chopping potential function.

TABLE 124

Tool function by time category and site.

Time Category 1:

	Site							
	22It539		22It576		22It590		22It621	
Function	N	%	N	%	N	%	N	%
Potential cutting soft	0		0		5	1.7	2	3.3
Potential cut/saw medium/hard	2	1.2	1	.4	7	2.4	0	
Potential piercing soft	0		1	.4	5	1.7	1	1.5
Potential drill/grave medium/hard	0		0		3	1.0	0	
Potential scraping soft	1	.6	0		0		0	
Potential scraping/planing hard	0		0		2	.7	0	
Potential chopping	0		0		1	.3	0	
Possible backed edge	0		1	.4	0		4	6.6
Cutting/sawing soft	62	38.3	88	35.2	54	18.3	10	16.4
Cutting/sawing medium	27	16.7	34	13.6	28	9.5	7	11.5
Cutting/sawing hard	4	2.5	1	.4	1	.3	4	6.6
Cutting/sawing medium/hard	5	3.1	6	2.4	14	4.7	4	6.6
Perforating soft/medium	3	1.9	12	4.8	15	5.1	8	13.1
Drilling medium	0		1	.4	1	.3	1	1.6
Drilling hard	0		0		0		0	
Drilling	0		0		4	1.4	1	1.6
Scraping/planing soft	0		0		1	.3	0	
Scraping/planing medium	5	3.1	13	5.2	7	2.4	3	4.9
Scraping/planing hard	1	.6	4	1.6	2	.7	2	3.3
Scraping dry hide	1	.6	3	1.2	1	.3	0	
Scraping	24	14.8	36	14.4	62	21.0	9	14.8
Chopping/pounding soft/medium	0		1	.4	1	.3	1	1.6
Chopping/pounding hard	2	1.2	0		13	4.4	0	
Slotting/grooving/ingraving	7	4.3	15	6.0	17	5.8	1	1.6
Wedging	0		2	.8	3	1.0	0	
Tool backing (hard wear)	12	7.4	23	9.2	19	6.4	0	
Raw material supply	3	1.9	3	1.2	8	2.7	2	3.3
Pigment source	0		1	.4	5	1.7	0	
Practice piece	0		0		0		0	
Other non-utilitarian	0		0		0		0	
Abrading (a)	1	.6	1	.4	11	3.7	0	
Abrading (b)	1	.6	0		0		0	
Anvil	0		0		0		0	
Nutting stone	1	.6	0		2	.7	0	
Possible projectile - impact	0		3	1.2	3	1.0	1	1.6
Total @	162	100.0	250	100.0	295	100.0	61	100.0

Time Category 2:

	Site							
	22It539		22It576		22It590		22It621	
Function	N	%	N	%	N	%	N	%
Potential cutting soft	9	1.2	0		1	1.5	3	1.5
Potential cut/saw medium/hard	10	1.4	0		1	1.5	2	.9
Potential piercing soft	2	.3	0		0		1	.4
Potential drill/grave medium/hard	6	.8	0		1	1.5	3	1.3
Potential scraping soft	1	.1	0		0		0	
Potential scraping/planing hard	0		0		0		1	.4

TABLE 124
Tool function by time category and site (continued).

Time Category 2:	Site							
	22It539		22It576		22It590		22It621	
Function	N	%	N	%	N	%	N	%
Potential chopping	0		0		0		0	
Possible backed edge	3	.4	0		0		2	.9
Cutting/sawing soft	180	24.4	10	27.0	11	16.4	22	9.7
Cutting/sawing medium	85	11.5	4	10.8	8	11.9	20	8.8
Cutting/sawing hard	14	1.9	0		0		3	1.3
Cutting/sawing medium/hard	22	3.0	5	13.5	3	4.5	10	4.4
Perforating soft/medium	38	5.2	0		7	10.4	40	17.7
Drilling medium	8	1.1	0		0		4	1.8
Drilling hard	0		0		0		1	.4
Drilling	1	1.1	0		0		9	4.0
Scraping/planing soft	3	.4	0		3	4.5	5	2.2
Scraping/planing medium	39	5.3	3	8.1	0		8	3.6
Scraping/planing hard	21	2.8	0		1	1.5	3	1.3
Scraping dry hide	9	1.2	0		0		6	2.7
Scraping	122	16.6	6	16.2	10	14.8	39	17.3
Chopping/pounding soft/medium	0		0		1	1.5	0	
Chopping/pounding hard	7	1.0	2	5.4	3	4.5	5	2.2
Slotting/grooving/ingraving	73	9.9	2	5.4	4	6.0	3	1.3
Wedging	0		0		1	1.5	2	.9
Tool backing (hard wear)	22	3.0	2	5.4	4	6.0	3	1.3
Raw material supply	19	2.6	0		3	4.5	12	5.4
Pigment source	3	.4	0		0		0	
Practice piece	1	.1	1	2.7	1	1.5	0	
Other non-utilitarian	4	.5	2	5.4	1	1.5	0	
Abrading (a)	27	3.7	0		5	7.5	6	2.7
Abrading (b)	2	.3	0		0		1	.4
Anvil	5	.7	0		0		1	.4
Nutting stone	0		0		0		1	.4
Possible projectile - impact	1	.1	0		1	1.5	4	1.8
Total	727	100.0	37	99.9	67	100.0	226	99.9

Time Category 4:	Site					
	22It539		22It576		22It590	
Function	N	%	N	%	N	%
Potential cutting soft	1	.8				
Potential cut/saw medium/hard	3	2.3	1	7.1	2	2.3
Potential piercing soft	0		0		0	
Potential drill/grave medium/hard	3	2.3	1	7.1	1	1.2
Potential scraping soft	0		0		0	
Potential scraping/planing hard	0		0		0	
Potential chopping	0		0		1	1.1
Possible backed edge	0		0		0	
Cutting/sawing soft	10	7.8	0		19	21.6
Cutting/sawing medium	15	11.6	1	7.1	11	12.5
Cutting/sawing hard	4	3.1	0		2	2.3
Cutting/sawing medium/hard	10	7.8	1	7.1	2	2.3

TABLE 124

Tool function by time category and site (continued).

Time Category 4:	Site					
	22It539		22It576		22It590	
Function	N	%	N	%	N	%
Perforating soft/medium	19	14.7	2	14.3	3	3.4
Drilling medium	3	2.3	0		1	1.1
Drilling hard	0		0		0	
Drilling	1	.8	0		2	2.3
Scraping/planing soft	0		0		0	
Scraping/planing medium	6	4.7	0		0	
Scraping/planing hard	7	5.4	0		0	
Scraping dry hide	0		1	7.1	0	
Scraping	11	8.5	0		14	15.9
Chopping/pounding soft/medium	1	.8	0		0	
Chopping/pounding hard	0		0		5	5.7
Slotting/grooving/ingraving	11	8.5	0		7	8.0
Wedging	0		0		0	
Tool backing (hard wear)	8	6.2	2	14.3	3	3.4
Raw material supply	4	3.1	0		2	2.3
Pigment source	4	3.1	0		3	3.4
Practice piece	0		0		0	
Other non-utilitarian	0		2	14.3	0	
Abrading (a)	4	3.1	2	14.3	8	9.1
Abrading (b)	1	.8	0		0	
Anvil	0		1	7.1	1	1.1
Nutting stone	0		0		0	
Possible projectile - impact	3	2.3	0		1	1.1
Total	129		14**	99.9	88	100.0

Time Category 5:	Site							
	22It539		22It576		22It590		22It621	
Function	N	%	N	%	N	%	N	%
Potential cutting soft	3	1.0	1	6.3	0		2	1.5
Potential cut/saw medium/hard	17	5.8	1	6.3	0		2	1.5
Potential piercing soft	1	.3	1	6.3	0		1	.8
Potential drill/grave medium/hard	6	2.0	0		0		1	.8
Potential scraping soft	0		0		0		0	
Potential scraping/planing hard	0		0		0		0	
Potential chopping	1	1.3	0		0		2	1.5
Possible backed edge	4	1.4						
Cutting/sawing soft	25	8.5	4	25.0	1	12.5	13	9.9
Cutting/sawing medium	15	5.1	0		0		4	3.1
Cutting/sawing hard	5	1.7	0		0		2	1.5
Cutting/sawing medium/hard	22	7.5	1	6.3	0		13	9.9
Perforating soft/medium	36	12.2	2	12.5	2	25.0	8	6.1
Drilling medium	3	1.0	0		0		6	4.6
Drilling hard	1	.3	0		0		0	
Drilling	0		0		0		6	4.6

TABLE 124

Tool function by time category and site (continued).

Time Category 5:

Function	Site 22It539 N	 %	 22It576 N	 %	 22It590 N	 %	 22It621 N	 %
Scraping/planing soft	0		0		0		2	1.5
Scraping/planing medium	4	1.4	0		0		3	2.3
Scraping/planing hard	3	1.0	0		0		1	.8
Scraping dry hide	1	.3	0		0		3	2.3
Scraping	64	21.8	1	6.3	0		27	20.6
Chopping/pounding soft/medium	1	.3	0		0		0	
Chopping/pounding hard	3	1.0	2	12.5	0		5	3.8
Slotting/grooving/ingraving	16	5.4	0		0		10	7.6
Wedging	4	1.4	1	6.3	0		0	
Tool backing (hard wear)	3	1.0	0		0		3	2.3
Raw material supply	18	6.1	1	6.3	2	25.0	3	2.3
Pigment source	7	2.4	0		0		3	2.3
Practice piece	3	1.0	0		0		0	
Other non-utilitarian	3	1.0	0		0		1	.8
Abrading (a)	20	6.8	0		3	37.5	6	4.6
Abrading (b)	2	.7	0		0		3	2.3
Anvil	3	1.0	0		0		0	
Nutting stone	1	.3	0		0		1	.8
Possible projectile - impact	0		1	6.3	0		0	
Total	294	100.0	16**	100.0	8**	100.0	131	100.1

Time Category 6:

Function	Site 22It623/22It624 N	 %
Potential cutting soft	5	1.8
Potential cut/saw medium/hard	6	2.2
Potential piercing soft	2	.7
Potential drill/grave medium/hard	1	.4
Potential scraping soft	0	
Potential scraping/planing hard	1	.4
Potential chopping	0	
Possible backed edge	0	
Cutting/sawing soft	37	13.4
Cutting/sawing medium	15	5.4
Cutting/sawing hard	6	2.2
Cutting/sawing medium/hard	21	7.6
Perforating soft/medium	22	7.9
Drilling medium	6	2.2
Drilling hard	0	
Drilling	7	2.5
Scraping/planing soft	0	
Scraping/planing medium	17	6.3
Scraping/planing hard	5	1.8
Scraping dry hide	4	1.4
Scraping	38	13.8

TABLE 124
Tool function by time category and site (continued).

Time Category 6:	Site	
	22It623/22It624	
Function	N	%
Chopping/pounding soft/medium	1	.4
Chopping/pounding hard	2	.7
Slotting/grooving/ingraving	12	4.3
Wedging	0	
Tool backing (hard wear)	8	2.9
Raw material supply	7	2.5
Pigment source	3	1.1
Practice piece	0	
Other non-utilitarian	2	.7
Abrading (a)	38	13.8
Abrading (b)	4	1.4
Anvil	0	
Nutting stone	1	.4
Possible projectile - impact	5	1.8
Total	276	99.9

* This table does not include those functions scored as "used edges"; edges that show use wear, but to which no specific function could be assigned.
** Represented by features only
@ Totals may exceed the total number of tools because tools often have more than one function.

Twenty-seven different functions have been recorded for tools based on the presence of use-wear. These functions need to be examined with caution for several reasons 1) the experimental use-wear studies were limited, 2) use-wear will usually reflect only the last or the most destructive activity for which the tool was used, and 3) it is by no means certain that the tool was used at the site from which it was recovered. It is possible at best to get a general idea of the range of activities for which chipped stone and ground stone tools were used at a site. Although diversity statistics were not generated for tool function, assemblage diversity and evenness are apparent from the number and percentages of different use-wear types present. If the number of functions present is arbitrarily partitioned into low (10-17 different functions), medium (18-22 different functions) and high (23-27 functions) categories, sample units diversity can be assessed as follows:

high diversity	medium diversity	low diversity
22It539 T.C. 2	22It539 T.C. 4	22It539 T.C. 1
22It539 T.C. 5	22It576 T.C. 1	22It576 T.C. 2
22It621 T.C. 2	22It590 T.C. 1	22It590 T.C. 2
22It576 T.C. 3	22It621 T.C. 2	22It590 T.C. 4
	22It623/22It624 T.C. 5	22It621 T.C. 1
	22It623/22It624 T.C. 6	

T.C. = time category

Diversity does not show a consistent pattern by site or by time category. Nor does diversity in tool function necessarily correspond to diversity in technological class. For example, 22It590 time category 2 has the highest diversity score in terms of technology but low functions diversity. Tools made in different ways are used for some of the same functions. On the other other hand, 22It621 time category 2 is high in functional diversity and low in technological diversity. Tools made in the same manner are used for a variety of functions. With these caveats it could be posited that units with more diverse functions represent longer term occupation. If this is so, then base camp occupations were present in the early Middle Archaic.

The percentages of tool function are very uneven in all units. The most frequent occurring uses are partly a function of the specificity with which a use-wear pattern could be applied during analysis. Cutting soft, medium, and hard materials and scraping are important tool functions in all units. These uses can be considered a base line functional assemblage. Perforating soft materials and drilling medium or hard materials and scraping dry hide, graving, wedging, abrading, providing raw material are usually less frequent functions and are far more important in some units than others. All of these activities can be associated with maintenance tasks, and their importance at a site may reflect its status as a base camp habitation. A scale can be devised to measure additions to the baseline functional assemblage. Sample units are given a point for each additional function contributing 5% or more to the tool assemblage, and the results are presented below. The units with the most point are the most likely to be multipurpose camps.

Unit		1	2	3	4	5
22It539	time category 1	x				
	time category 2			x		
	time category 4				x	
	time category 5				x	
22It576	time category 1			x		
	time category 2				x	
	time category 3			x		
22It590	time category 1		x			
	time category 2					x
	time category 4			x		
22It621	time category 1		x			
	time category 2			x		
22It623/ 22It624	time category 5					x
	time category 6				x	

Using this scale it also appears that at least two base camps are present in the Upper Tombigbee Valley during the Middle Archiac 1 period.

TOOL DISPOSAL AND INTENSITY OF SITE USE

Other aspects of assemblage analysis addressed are the intensity of tool use and tool disposal. The percent of whole and broken tools is an indication of intensity of tool use and site use. The longer a tool is used, the greater its chance of being broken. The longer the site is used, or if more people live at a site, the more likely tools will be broken. Data on whole and broken tools (Table 125) show that the highest percentage of whole tools (52-62%) are in the earlier time categories, especially those units represented by features only (22It576 time categories 4 and 5; 22It590 time category 5). Since most of the features are pits, the high percentage of broken tools probably represents the final use of these facilities as dumps or garbage pits. Although the density of tools and debitage are greatest at 22It539 and 22It590 during time category 2, the percentage of broken tools is low (37.3%) and (53.0%), respectively). At 22It590 tools may be used less even if the site is more intensely used. The percentage of tools with more than one recorded use is low, but this is not so for 22It539. 22It539 does have a relatively high percentage of recycled tools, tools presumably broken and reworked. At 22It576 time categories 2 and 3, unlike most units from earlier parts of the Archaic, have very high percentages of broken tools. Artifact density is low to moderate and the percentages of tools with more than one recorded function is low. During time category 2 at 22It576, the high percentage of broken tools may represent manufacturing activities. Early stages of biface reduction are well represented, and over half the tools had no functions recorded at all. The percentage of recycled tools is also low.

TABLE 125
Artifact completeness by time category*.

Time		22It539		22It576		22It590		22It621		22It623/22It624	
Category	Complete	N	%	N	%	N	%	N	%	N	%
1	Whole	130	52.2	208	52.7	254	42.1	76	41.5		
	Broken	111	44.6	184	46.6	341	56.5	101	55.2		
	C.D.	8	3.2	3	.8	9	1.5	6	3.3		
	Total	249	100	395	100	604	100	183	100		
2	Whole	662	62.2	24	31.2	63	47.0	195	42.0		
	Broken	397	37.3	53	68.8	71	53.0	266	57.3		
	C.D.	5	.5	0		0		3	.6		
	Total	1,064	100	77	100	134	100	464	100		
3	Whole			313	35.9						
	Broken			556	68.8						
	C.D.			3	.3						
	Total			872	100						
4	Whole	106	33.3	5	29.4	83	39.2				
	Broken	211	66.4	12	70.6	128	60.4				
	C.D.	1	.3	0		1	.5				
	Total	318	100	17**	100	212	100				
5	Whole	263	35.3	14	31.1	6	31.6			119	42.8
	Broken	478	64.2	31	68.9	12	63.2			158	56.8
	C.D.	3	.4	0		1	.5			1	.4
	Total	744	99.9	45**	100	19**	100			278	100
6	Whole									295	34.6
	Broken									384	64.8
	C.D.									3	.5
	Total									592	99.9

* chert only
** Represented by features only
C.D.=can't determine

Another variable which tracks the intesity of tools use and disposal is USE STAGE (Table 126). Resharpening, as well as recycling, is monitored. Resharpening signals intensity of tool use. Both the resharpening and recycling stages were important at 22It539 during time categories 4 and 5 and is probably associated with more intensive use of Fort Payne chert.

TABLE 126
Artifact use stage by time category*.

		22It539		22It576		22It590		22It621		22It623/22It624	
TC	Use Stage	N	%	N	%	N	%	N	%	N	%
1	Unused	37	17.2	78	21.9	165	31.6	77	45.6		
	Used/Useful	107	49.8	185	51.9	218	41.8	56	33.1		
	Used/Discard	55	25.5	78	21.9	116	22.2	31	18.3		
	Reshrp/Useful	1	.5	5	1.4	8	1.5	2	1.2		
	Reshrp/Discard	3	1.4	2	.6	9	1.7	2	1.2		
	Recyc/Useful	12	5.6	8	2.3	5	1.0	1	.6		
	Recyc/Discard	0		0		1	.2	0			
	Total	215	100	356	100	522	100	169	100		
2	Unused	163	17.1	25	38.5	28	24.6	135	32.2		
	Used/Useful	526	55.1	17	26.1	55	48.2	150	35.8		
	Used/Discard	182	19.1	22	33.9	29	25.4	112	26.7		
	Reshrp/Useful	7	.7	1	1.5	1	.9	9	2.1		
	Reshrp/Discard	9	.9	0		0		3	.7		
	Recyc/Useful	65	6.8	0		1	.9	8	2.0		
	Recyc/Discard	2	.2	0		0		2	.5		
	Total	954	99.9	65	100	114	100	419	100		
3	Unused			159	21.6						
	Used/Useful			246	33.4						
	Used/Discard			307	41.7						
	Reshrp/Useful			10	1.4						
	Reshrp/Discard			6	.8						
	Recyc/Useful			8	1.1						
	Recyc/Discard			0							
	Total			756	100						
4	Unused	46	19.1	3	20.0	58	33.1				
	Used/Useful	70	29.1	5	33.3	60	34.3				
	Used/Discard	97	40.2	5	33.3	46	26.3				
	Reshrp/Useful	4	1.7	1	6.7	1	.6				
	Reshrp/Discard	10	4.1	0		5	2.9				
	Recyc/Useful	13	5.4	0		5	2.9				
	Recyc/Discard	1	.4	0	6.7	0	2.9				
	Total	241	100	15**	100	175	100				
5	Unused	95	17.4	6	22.2	3	21.4			59	25.0
	Used/Useful	176	32.2	10	37.0	2	14.3			87	36.9
	Used/Discard	198	36.3	8	29.6	6	42.9			78	33.1
	Reshrp/Useful	17	3.1	0		0				3	1.3
	Reshrp/Discard	28	5.1	1	7.4	1	7.1			3	1.3
	Recyc/Useful	26	4.8	2	3.7	2	14.3			6	2.5
	Recyc/Discard	5	.9	0		0				0	
	Total	545	99.9	27**	99.9	14**	100			236	100

TABLE 126
Artifact use stage by time category* (continued).

TC	Use Stage	22It539 N	22It539 %	22It576 N	22It576 %	22It590 N	22It590 %	22It621 N	22It621 %	22It623/22It624 N	22It623/22It624 %
6	Unused									92	20.9
	Used/Useful									154	34.7
	Used/Discard									165	37.4
	Reshrp/Useful									5	1.1
	Reshrp/Discard									13	2.9
	Recyc/Useful									9	2.0
	Recyc/Discard									4	.9
	Total									441	99.9

* Chert only; items scored "can't determine" and "not applicable" not included.

** Represented by features only.

The recording of fracture types was undertaken to investigate the relationship between breakage and life cycles. One thousand seven hundred and seventy-seven items display one fracture type. In a few cases this fracture type is represented more than once on the item (Table 127). Seven hundred and twenty-four have a combination of break types. Of these, 477 have two break types present, and 157 have combinations of three break types. By far the most common type of fracture found in the archaeological specimens in the sample is some form of transverse fracture - transverse (n=297), transverse with lip (n=374), and transverse with tongue (n=115). The diagonal fracture, similar in form to the transverse fracture, but with a different orientation to the long axis of the tool, is also a prominent type (n=270). Combinations of transverse and diagonal fractures are most common combination of fracture types. Singly, or in combination, transverse and diagonal fractures make up 61% of the fractures in the sample. Fractures caused by heating are next in frequency 0 crenated (n=273) and expansion and pot lid (n=189). There are 70 examples of combinations of heat fractures, and 54 combinations of heat fractures and other fracture types. Singly, or in combination, heat fractures make up 23.2% of the fractures in the sample.

TABLE 127
Frequency of fracture types for the entire sample*.

Fracture Type	Frequency	Percentage
Perverse	23	1.0
Overshot	16	.7
Diagonal	270	12.2
Transverse	297	13.4
Transverse with lip	374	16.8
Transverse with tongue	115	5.2
Direct surface	77	3.5
Crenated	273	12.3
Expansion	182	8.2
Pot lid	7	.3
Impact	11	.5
Haft snap	79	3.6
Natural flaw	21	.9

TABLE 127
Frequency of fracture types for the entire sample* (continued).

Fracture Type	Frequency	Percentage
Combination of heat fractures	70	3.2
Combination of heat and other fracture type	54	2.4
Combination of material flaw and other fracture type	37	1.7
Combination transverse	58	2.6
Transverse and diagonal	240	10.8
Transverse and impact	1	.8
Total	2,222	100.0

* total does not include the following:

Other	32
Other combination	157
Not applicable	3,173
Can't determine	700

Fractures involving natural flaws in raw material are few. Only 21 examples of single breaks resulting from a material flaw are present in the sample. Thirty-seven specimens have a fracture generated along a material flaw in combination with some other fracture type. The low percent (2.6%) of material flaw fracture attests to the good quality of the raw materials available to midden mound inhabitants. Perverse (n=23; 1%), overshot (n=16; 7%), impact (n=29; 1.3% [includes combinations of impact and transverse]), and haft snaps (n=79: 3.6%) account for the rest of the identified fracture types. Impact fractures and haft snaps indicate the cause or position of the fracture. Morphologically these fractures are transverse or diagonal.

As can be seen in Table 128, the frequency of fracture types on Fort Payne chert differs from that of all cherts. Heat-related fractures are far more common on Fort Payne chert; single occurrence frequency is 21.2% greater in Fort Payne chert. The single occurrence of diagonal or transverse fractures is correspondingly 18.6% less than for all chert. Difference between Fort Payne and all cherts for other fracture types and for combinations of fracture types are slight.

TABLE 128
Frequency of fracture types - 1.

	All Chert		Fort Payne Chert	
Fracture Type	Number	Percentage	Number	Percentage
Perverse	23	1.0	2	.4
Overshot	16	.7	1	.2
Diagonal or any transverse-single occurance	1,056	47.5	151	28.9
Direct surface	77	3.5		
Heat related - single occurance	362	16.3	195	37.4
Impact and Impact & Transverse	29	1.3	5	1.0
Haft snap	79	3.6	27	5.2
Natural flaw and combination natural flaw and other fracture types	58	2.6	1	.2

TABLE 128
Frequency of fracture types - 1 (continued).

Fracture Type	All Chert Number	Percentage	Fort Payne Chert Number	Percentage
Combination of heat fractures and heat and other fracture types	224	10.1	50	9.6
Combination Transverse and Transverse & Diagonal	298	13.4	69	13.2
Total	2,222	100.0	522	100.1

Frequency of combined fracture types - 2.

Fracture Type	All Chert Number	Percentage	Fort Payne Chert Number	Percentage
Perverse	23	1.0	2	.4
Overshot	16	.7	1	.2
Direct surface	77	3.5		
Impact and Impact & Transverse	29	1.3	5	1.0
Haft snap	79	3.6	27	5.2
Natural flaw and combination natural flaw and other fracture types	58	2.6	1	.2
All heat related	586	26.4	245	46.9
All Diagonal and Transverse	1,354	60.9	220	42.1
Total	2,222	100.0	522	100.1

Cross-tabulation of fracture type and production stage (Table 129) shows that most fracture types are associated with finished tools. Since the hafting element of a tool is usually the last step in manufacture, it is not surprising that all haft snaps occur on finished tools. The fractures are probably due to use, but the specific use is unknown, since the blade element is missing. No refit blades and haft elements were found. Impact fractures occur only in the later stages of production and are also likely to be use-related. Although diagonal and transverse fractures are present singly, or in combination, at all stages of reduction, they are far more common in finished tools (86%). Eighty-two percent of the heat-related fractures are associated with finished tools and are likely unintentional results. Only 8-10% of heat fractures are associated with early stages of biface reduction (biface 1 and 2). These may also be unintentional results of heat treatment failure. If this is the case for at least some fractures, then the rate of heat-treatment failure is generally low. It is also possible that most heat treatment took place at other sites, and failures were not brought to the sites in our study. The relatively few genuinely fire-craked chunks in the "fire-cracked chert" category favors the second interpretation.

Comparisons of fracture types by site and by time category show two trends (Table 130). The occurrence of single or combination heat-fractures increases in later time categories, and the percentage of all combinations of fracture types also increases through time. The increase in heat fractures is in part related to the increased amount of Fort Payne (22It539 and 22It623/22It624) but may be related to more intense site use as well (22It590). Except in feature context, material flaws are few in later time categories. The relatively high percentage of material flaws at 22It576 in time categories 1

TABLE 129

Combined fracture types by site and time category*.

	22It539		22It576		22It590		22It621		22It623/22It624	
Use Stage	N	%	N	%	N	%	N	%	N	%
T.C. 1										
Perverse/Overshot	2	2.8	6	5.0	7	3.4	5	6.9		
Diag/Trsv-single	44	61.1	66	54.4	112	53.8	39	54.1		
Direct surface	1	1.4	4	3.3	5	2.4	0			
Heat-single	15	20.8	14	11.6	24	11.5	13	18.1		
Impact	0		3	2.5	2	1.0	3	4.2		
Haft snap	2	2.8	4	3.3	14	6.7	3	4.2		
Material flaw	2	2.8	8	6.6	6	2.9	2	2.8		
Heat-combined	0		5	4.1	5	2.4	2	2.8		
Diag/Trsv-combined	6	8.3	11	9.1	33	15.9	5	6.9		
Total	72	100	121	100	208	100	72	100		
T.C. 2										
Perverse/Overshot	5	2.2	0		1	2.7	5	2.5		
Diag/Trsv-single	117	52.0	14	50.0	18	48.6	114	57.9		
Direct surface	10	4.4	1	3.6	0		4	2.0		
Heat-single	56	24.9	4	14.3	5	13.5	24	12.2		
Impact	1	.4	0		1	2.7	6	3.0		
Haft snap	2	.9	1	3.6	0		9	4.6		
Material flaw	9	4.0	4	14.3	4	10.8	6	3.1		
Heat-combined	8	3.6	0		2	5.4	10	5.1		
Diag/Trsv-combined	17	7.6	4	14.3	6	16.2	19	9.6		
Total	225	100	28	100	37	99.9	197	100		
T.C. 3										
Perverse/Overshot			1	.3						
Diag/Trsv-single			170	52.5						
Direct surface			2	.6						
Heat-single			56	17.3						
Impact			0							
Haft snap			9	2.8						
Material flaw			8	2.5						
Heat-combined			9	2.8						
Diag/Trsv-combined			69	21.3						
Total			324	100						
T.C. 4										
Perverse/Overshot	4	2.8	0		0					
Diag/Trsv-single	56	39.4	2	33.3	30	40.5				
Direct surface	10	7.0	0		1	1.4				
Heat-single	38	26.8	1	16.7	20	27.0				

TABLE 129

Combined fracture types by site and time category* (continued).

Use Stage	22It539 N	22It539 %	22It576 N	22It576 %	22It590 N	22It590 %	22It621 N	22It621 %	22It623/22It624 N	22It623/22It624 %
T.C. 4										
Impact	0	3.5	0		0					
Haft snap	5	3.5	0		4	5.4				
Material flaw	1	.7	2	33.3	3	4.0				
Heat-combined	11	7.7	1	16.7	4	5.4				
Diag/Trsv-combined	17	12.0	0		12	16.2				
Total	142	99.9	6**	100	72	100				
Time category 5										
Perverse/Overshot	1	.3	0		0				1	1.0
Diag/Trsv-single	116	37.8	6	27.3	3	75.0			47	49.5
Direct surface	12	3.9	2	9.0	0				6	6.3
Heat-single	96	31.3	8	36.4	1	25.0			7	7.4
Impact	1	.3	0		0				3	3.2
Haft snap	16	5.2	0		0				1	1.0
Material flaw	3	1.0	0		0				0	
Heat-combined	26	8.5	2	9.0	0				10	10.5
Diag/Trsv-combined	36	11.7	4	18.2	0				20	21.1
Total	307	100	22	99.9**	4	100**			95	100
Time category 6										
Perverse/Overshot									1	.4
Diag/Trsv-single									102	36.0
Direct surface									19	6.7
Heat-single									80	28.3
Impact									7	2.5
Haft snap									10	3.5
Material flaw									0	
Heat-combined									27	9.5
Diag/Trsv-combined									37	13.1
Total									238	100

* This table does not include items scored "other", "other combination", "can't determine", and "not applicable".

** Represented by features only.

2 and at 22It590 in time category 2 may indicated restricted access to good raw materials or increased manufacturing activity.

Density of cultural materials is often used as an indicator of site use intensity. Intensity of site use increases as more individuals occupy an area for a given period of time, or as the length of time a given group of people spent at a site increases, or both. Natural phenomena, such as rate of sedimentation or deflation, also effect density. Site sampling may present problems as well. For this reason several blocks and features from each site and time category were included in the units for Phase III lithic analysis when possible. Usually the block at the center of the site and one or more peripheral blocks were included in the sample for each time period. The documentation of the relatively low rate of sedimentation and energy investment in site structures leads to an expectation that tool and debitage density should be greater during time categories 4, 5, and 6, the later part of the Middle Archaic and Late Archaic. Actually, the densities were highest during the early Middle Archaic at 22It539 and 22It590.

The density of tools and debitage for midden and feature units in the sample studied has been calculated for each time category (Table 130). The densities are based on the total numbers of tools and debitage recorded for each site, block, and level (see Tables 12 and 13 of Appendix III). These data, rather than those for tools and debitage examined in the lithic study, have been used to calculate densities because of retrieval problems and the small sample of debitage examined during this study.

TABLE 130

Tool and debitage densities by site and time category (number of items per m^3).

	Time Category					
Site	1	2	3	4	5	6
22It539						
Tools	11.9	109.2		51.6	52.0	
Debitage	352.1	1,586.1		341.6	165.8	
22It576						
Tools	6.0	3.0	30.6			
Debitage	72.7	27.9	197.3			
22It590						
Tools	29.0	88.1		35.2		
Debitage	596.5	1,933.1		277.8		
22It621						
Tools	10.2	33.6				
Debitage	173.3	294.6				
22It623/22It624						
Tools					23.9	34.7
Debitage					104.4	229.1

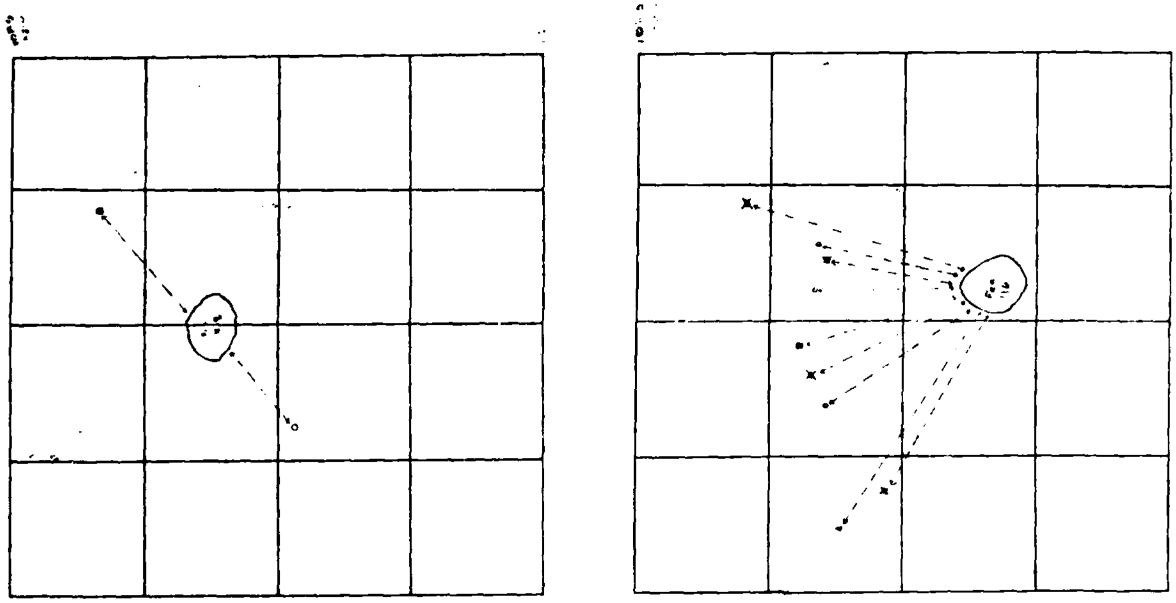
Differences in artifact and debitage densities are evident both among sites within the same time category and among different time categories at the same site, but the reasons for these differences are difficult to determine. In fact, artifact densities are lowest during the Early Archaic, are moderate to high during the earlier Middle Archaic, and are moderate during the later part of the Middle Archaic and Late Archaic. Little patterning exists in the debitage densities. Debitage densities are low to moderate at all site and all time categories except 22It539 and 22It590 during the early Middle Archaic.

22It576 has low densities for both tools and debitage during the Early Archaic and early Middle Archaic periods. The presence of several knapping concentrations, Features 116 and 118 in particular, and another concentration of over 600 flakes in the northwest corner of the large excavation block, the presence of crude-to-medium broken bifaces, and the presence of spent tools indicates that the site was used as a manufacturing and retooling station during at least one early occupation. Time category 1 (Kirk), Levels 15 and

16 proved an unusual opportunity to describe one activity prominent at the site. Four blocks at 22It576 were excavated to levels that might contain Early Archaic deposits. Only the western two-thirds of Block D (12x8 m or 39.6x26.4 ft)) contained ten artifacts and pieces of debitage or more. The occupation associated with these levels appears to be restricted to the center high area of the site. The density of artifacts within these two levels of Block D is 14.6 per cubic meter, the density of debitage is 182.0 per cubic meter. These figures are in line with the other Early Archaic assemblages.

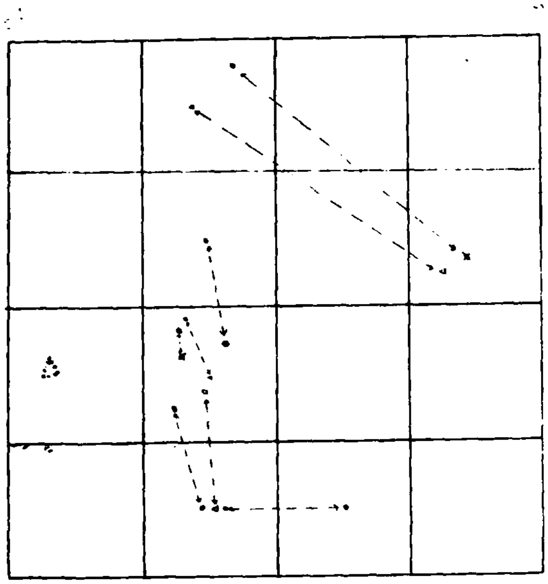
During the lithic analysis, 270 tools were examined from Levels 15 and 16 midden. Twenty-one tools and 487 pieces of debitage were examined from Features 116 and 118 at 22It576. These features were lithic concentrations within two meters (6.6 ft) of each other. Both features were subjected to a refitting analysis which revealed new information on their composition. Lithic material from Feature 118 is almost exclusively non-heated yellow or Camden chert. Based on evaluation of raw material color, texture, and cortex debitage, four different cobbles are represented. Two artifacts in the immediate vicinity of the feature appear to be made of material present in Feature 118 (Figure 49). Lithic material from five or more cobbles of heated Camden chert predominates in Feature 116. The distinct mottling and veining characteristic of heated Camden chert makes it possible to recognize individual cobbles. No attempt was made to reconstruct cobbles from the piles of debitage. Nine tools or pieces of debitage arranged in an arc approximately 1.5 m (5 ft) to the northwest from both Levels 15 and 16 appear to be made of material from Feature 116 (Figure 49). Flake size and amount of cortex on the flakes indicates that earlier or less refined stages of reduction are represented by the heated materials in Feature 116. The concentration of debitage in the northwest corner of the unit is predominately small (1/4 inch) flakes of heated chert without cortex. No heat-treatment facility was identified in the excavated units. It is not possible to determine if any of the unheated material was subsequently heated and then further reduced. There are cores or core fragments in the assemblage. It is possible that large bifaces, both heated and unheated, were brought to the site and reduced.

Nineteen artifact fragments were refit, both within and between Levels 15 and 16. Several of these were crude-to-medium bifaces that appear to have been broken during manufacture. They are all made of materials similar to those found in the features and lithic concentration. None of the whole, finished, shaped tools appear to match the concentrations of debitage. Three of these whole finished tools are small, Kirk bifaces with steeply beveled edges. It is tempting to posit that these stone elements have been removed from their shafts, discarded, and replaced with new, larger pieces. These refurbished tools may than have been removed from the site for use elsewhere (Jeske, personal communication 1985; Stevenson 1985). Tools broken during manufacture and left at the site contributed to the moderate debitage-to-tool ratios (Table 131) for these levels. Alternatively, the tools may have been related to other activities that also occurred during that occupation. Recorded functions for tools in these levels show a wide variety of uses as knives, saws, drills, and scraper.



Refitting flakes from cobbles in Feature 118

Refitted flakes from cobbles in Feature 116



Refitting pieces from general midden Levels 15 and 16

Figure 49 Distribution of flakes from cobbles and refit pieces.

TABLE 131

Tool-to-debitage ratios.

Block	Level	T.C.	Tools	Debitage	Debitage-to-Tool Ratio
				22It539	
A	5	5	77	340	4.4
A	6	5	44	237	5.3
A	7	5	25	149	6.0
A	8	5	42	135	3.2
A	9	5	72	282	3.9
A	10	5	89	353	4.0
Total			349	1,496	4.3
B	6	5	175	608	3.5
B	7	5	209	808	3.9
B	8	5	214	802	3.7
B	9	5	76	316	4.2
B	10	5	95	282	2.9
Total			829	2,816	3.4
Total T. C. 5			1,178	4,312	3.7
A	11	4	97	370	3.8
A	12	4	73	493	6.8
A	13	4	35	362	10.3
A	14	4	101	961	9.5
Total T.C. 4			306	2,186	7.1
A	15	2	125	1,341	10.7
A	16	2	99	1,397	14.1
A	17	2	117	1,342	11.5
Total			341	4,080	12.0
D	16	2	504	6,529	13.0
D	17	2	182	4,618	25.4
Total			686	11,147	16.2
Total T.C. 2			1,027	15,227	14.8
D	18	1	116	3,456	29.8
D	19	1	31	1,006	32.5
D	20	1	4	160	40.0
D	21	1	0	27	
Total T.C. 1			151	4,649	30.8

TABLE 131
Tool-to-debitage ratios (continued).

Block	Level	T.C.	Tools	Debitage	Debitage-to-Tool Ratio
				22It576	
D	9	3	328	2,129	6.5
D	10	3	316	2,454	7.8
D	11	3	119	1,098	9.2
Total T.C. 3			763	5,681	7.4
D	12	2	33	304	9.2
D	13	2	20	228	11.4
Total T.C. 2			53	532	10.0
D	14	1	64	432	6.8
D	15	1	141	2,163	15.3
D	16	1	132	1,332	10.1
D	17	1	21	491	23.9
D	18	1	3	66	22.0
D	19	1	3	26	8.6
D	20	1	1	25	25.0
D	21	1	1	17	17.0
Total T.C. 1			367	4,552	12.4
				22It590	
B	6	4	22	182	8.3
B	7	4	15	99	6.6
B	8	4	70	613	8.8
B	9	4	9	128	14.2
B	10	4	20	367	18.4
Total T.C. 4			136	1,389	10.2
AW	8	2	130	3,093	23.8
Total T.C. 2			130	3,093	23.8
AW	9	1	90	2,461	27.3
AW	10	1	42	1,206	28.7
AW	11	1	20	584	29.2
AW	12	1	4	149	37.3
Total			156	4,400	28.2
AY	9	1	155	3,001	19.4
AY	10	1	117	2,583	22.1
AY	11	1	34	1,119	32.9
AY	12	1	16	276	17.2
Total			322	6,979	21.7

TABLE 131
Tool-to-debitage ratios (continued).

Block	Level	T.C.	Tools	Debitage	Debitage-to-Tool Ratio
				22It590	
E	13	1	30	494	16.5
E	14	1	1	56	56.0
E	15	1	0	4	
Total			31	554	17.9
F	10	1	40	747	18.7
F	11	1	21	362	17.2
F	12	1	4	83	20.8
F	13	1	1	1	1.0
F	14	1	0	1	
Total			66	1,194	18.1
J	7	1	49	522	10.7
J	8	1	25	165	6.6
J	9	1	6	262	43.6
J	10	1	6	186	31.0
J	11	1	4	53	13.1
J	12	1	0	13	
Total			90	1,201	13.3
13	7	1	9	262	29.1
13	8	1	0	52	
13	9	1	1	14	14.0
13	10	1	0	3	
13	11	1	0	0	
13	12	1	0	0	
13	13	1	0	0	
Total			10	331	33.1
Total T.C. 1			675	14,659	21.7
				22It621	
A	6	2	22	554	10.1
A	7	2	59	642	10.9
A	8	2	88	1,230	14.0
A	9	2	44	532	12.1
Total			246	2,958	12.0
C	6	2	2		
C	7	2	4		
C	8	2	208	1,518	7.3
C	9	2	62	571	9.2
C	10.1	2	20	138	6.9
Total			296	2,227	7.5

TABLE 131
Tool-to-debitage ratios (continued).

Block	Level	T.C.	Tools	Debitage	Debitage-to-Tool Ratio
				22It621	
E	8	2	1		
E	9	2	74	1,225	16.6
E	10	2	33	189	5.7
Total			108	1,414	13.1
Total T.C. 2			650	6,599	10.2
A	10	1	26	513	19.7
A	11	1	12	628	52.3
A	12	1	13	443	34.1
A	13	1	8	219	27.4
A	14	1	1	148	148.0
A	15	1	4	116	29.0
A	16	1	1	20	20.0
Total			65	2,087	32.1
C	10.2	1	21	159	7.6
C	11	1	49	356	7.3
C	12	1	35	279	8.0
C	13	1	10	214	21.4
C	14	1	19	185	8.7
C	15	1	9	141	15.6
C	16	1	10	132	13.2
C	17	1	14	139	9.9
C	18	1	12	99	8.3
C	19	1	8	75	9.4
C	20	1	0	7	
C	21	1	0	2	
C	22	1	0	4	
C	23	1	0	1	
Total			187	1,793	9.5
Total T.C. 1			252	3,880	15.3
				22It623	
C	6	5	72	398	5.2
C	7	5	41	160	3.9
C	8	5	37	159	4.3
C	9	5	13	46	3.5
Total T.C. 5			163	596	4.7
D	6	6	47	365	7.8
D	7	6	18	231	12.8
Total T.C. 6			65	596	9.2

TABLE 131
Tool-to-debitage ratios (continued).

Block	Level	T.C.	Tools	Debitage	Debitage-to-Tool Ratio
				22It624	
A	6	6	58	770	13.3
A	7	6	46	374	8.1
Total			104	1,144	11.0
B	6	6	115	665	5.8
B	7	6	51	360	7.1
B	8	6	79	194	2.5
Total			245	1,219	5.0
C	6	6	52	472	9.0
C	7	6	18	150	8.3
C	8	6	8	84	10.5
Total			78	706	9.0
Total T.C. 6			427	3,496	8.2
A	8	5	20	149	7.5
A	9	5	26	90	3.5
Total T.C. 5			46	239	5.2

The highest densities of both tools and debitage during time category 2 at 22It539 and 22It590 were not anticipated. At 22It590 the debitage to tool ratio is the highest (23.8) of all the sites at all time periods. Since 22It590 is represented by a single 2x2 m (6.6x6.6 ft) block during this time category, our sample unit may not be representative of the site as a whole. It may be a knapping area from which finished tools have been removed to some other portion of the site or to some other site. The function identified for the remaining tools do not represent a wide range of activities. In contrast, 22It539 has a moderate debitage-to-tool ratio (14:8), but the functions recorded for the tools in the units examined from this time period are varied. The presence of burials at the site also attests to a more lengthly occupation.

Although the density of artifacts is relatively high at 22It539 during time periods 4 and 5, the debitage densities are low. The debitage to tool ratios indicate that far less tool manufacture took place than during earlier times. The debitage/tool ratios are similarly low at 22It623/22It624. During the latter part of the Archaic the increased use of Fort Payne chert probably accounts for these low ratios. Fort Payne is brought into the sites as unfinished bifaces or as finished tools. The finishing, or refurbishing, of these tools would produce primarily small debitage, often smaller than 1/4 inch.

Although the debitage-to-tool ratios differs from site to site and through time, the percentage of debitage in the three size categories (Table 13, Appendix III) is very consistent from site to site and through time. One-inch pieces comprise 1% or less of the debitage; 1/2 inch debitage ranges from 11-19% (if 22It623 and 22It624 are considered as on a site); and 1/4 inch debitage ranges from 81-89% of the total. The simple percentages of debitage categories either mask variation in manufacturing activity at these sites, or the manufacturing process is a very widespread and stable one.

SUMMARY

From examination of individual assemblages Archaic lithic technology appears to be essentially conservative. Variations in the assemblages are due to selection from a set of techniques known from at least the Early Archaic on, rather than to any innovation. The proposed increase in manufacture of narrow-bladed bifaces during the Late Archaic may be an exception. This conservatism can be seen in the forgoing look at raw material selection and treatment, technological classification, tool function, and tool disposal. Traditional tool morphology (Table 15, Appendix III) also reflects the conservatism. Several aspects of morphology are worth noting: 1) all of the assemblages are dominated by retouched and utilized flakes; 2) the percentage of hafted bifaces increases slightly through time; 3) and all other tool types, representing either technological or functional variation are usually found in small numbers in all units except those represented by feature material only.

It is not surprising that most of the lithic assemblage is made from locally available chert. This generally good quality chert was often heat treated after the initial shaping of cores or bifaces. Manufacture of tools from this local material took place at all of the sites in this study although evidence for the earliest stages of manufacture are slim. Non-local cherts or other chippable stone were brought into the site in the form of blanks or finished tools. Some of these exotic materials are present in all time periods, but the use of Fort Payne chert increase markedly during the late Middle Archaic and the Late Archaic at some sites. This increase in Fort Payne chert corresponds to a drop in the quality of local raw material, a decrease in the amount of heat treatment and an increase in heat alteration.

The density of debitage and tools in various units was to some extent unexpected. Specifically, the high density of material in the Early Archaic and early Middle Archaic indicate a level of activity of longevity of occupation unexpected at this early time period. The variation in density of tools and debitage among components argues for differences in site type or function. This notation is further investigated below.

TEST EXPECTATIONS FOR CHANGES IN MOBILITY STRATEGIES

The research design developed for this study included the possible causes for the changes in lithic assemblages that occur, or seem to occur, in the Upper Tombigbee River valley during the Archaic period. It has been argued that changes in mobility strategies placed different constraints on choices prehistoric people made during the manufacture and use of stone tools and that those constraints in many ways alter the composition of lithic assemblages. Changes are expected to occur in the selection and use of raw materials, in the amount of energy invested into tool manufacture, and in patterns of tool use. These issues will now be addressed utilizing data from this lithic study. The description of individual assemblages given above shows that there are differences in these variables among sites and among time periods, but that the patterning of these differences is sometimes difficult to discern.

To identify patterns in lithic technology the original units of analysis have been collapsed. Since transition from a more mobile to a more sedentary way-of-life is posited to begin with occupations containing Sykes-White

Springs and Benton bifaces, the provenience units were placed into one of three new time categories (NTC) 1) Early Archaic - time categories 1, 2, and 3 (pre-Sykes-White Springs/Benton); 2) Middle Archaic - time categories 4 and 5 (Sykes-White Springs/Benton); and 3) Late Archaic - time category 6 (post-Sykes-White Springs/Benton. Data is presented in the form of cross-tabulations of variables and these new time categories. In most cases Chi-square statistics are not reported, because the expected values in a high proportion of cells is under five, and the Chi-square statistics are unreliable. In addition, when matrices are larger than 2x2 m (6.6x6.6 ft) the reasons for a random or non-random distributions (even if statistically significant) is not straight forward. All tables for this section of the chapter appear in Appendix III.

It is important to note that the transition from residential camps to base camps proposed in the model was based on assessments of site structure, the density of all cultural material recovered, the presence of anthropedons, and only a general knowledge of lithic assemblages morphological characteristics from sites without regard to time period.

RAW MATERIAL SELECTION

The model for raw material selection predicts that during the Early Archaic the primary material used for chipped stone tools would be local, good quality chert (Camden, Tuscaloosa, and Yellow). The supply would have been plentiful and poor quality raw material could be rejected without penalty. Conversely, as occupations at sites became more intense during the Middle and Late Archaic, local raw material exhaustion would have become more likely. Therefore, more fair to poor quality raw materials would have been used for tool manufacture. Tables 15-17 in Appendix III shows that the quality of local raw materials does decline from Early through Middle to Late Archaic. This may be due in part to an increase in the amount of heat alteration in these periods which may obscure raw material quality.

The model's expectation for quality of raw material is that good quality local raw material was used for all types of tools during the Early Archaic. Later, when good quality material was at a premium, it would have been used selectively for those tools that require greater refinement. This study indicated that the use of local raw materials does not follow this pattern (Tables 18-20, Appendix III). Data show a shift from using local materials for "retouched only" pieces (15.8% to 8.2%) to bifaces (26.4% to 41.9%). The percentage of good quality local chert used for unifaces and utilized flakes also decreases. For the Late Archaic the pattern is somewhat different. Good quality raw materials were still used in biface manufacture but in the form of used or retouched bifacial reduction flakes as well as the bifaces themselves. The use of good quality local materials remains low for edge-retouched pieces but rises slightly for utilized flakes/chunks.

The model also predicts that plentiful, high quality material for tool manufacture would obviate the need for heat treatment during the Early Archaic. Heat treatment should be more pervasive during the Middle and Late Archaic as the supply of good quality raw material dwindles. Tables 21-32 (Appendix III) show that this was not the case. Heat treatment of all raw materials declined through time. Heat treatment of local cherts declined slightly, and heat treatment of nonlocal Fort Payne chert declines during the Late Archaic. According to the replicator (Kalin personal communication 1986) local good quality cherts are much easier to work once they are heated. Although the quality of this chert in terms of grain, flaws, of inclusions is good, workability is much improved with heating. This would be true during all time periods. During the Early and Middle Archaic, some of the Fort Payne chert is fossiliferous Fort Payne rather than blue-gray Fort Payne. Fossiliferous Fort Payne responds well to heating, while blue-gray Fort Payne does not. The decrease in heat treatment for Fort Payne chert is related to this shift from the fossiliferous to blue-gray Fort Payne.

It is expected that during the Early Archaic small quantities of a wide variety of nonlocal cherts might be found in assemblages probably in the form of finished tools. In the Middle and Late Archaic, if the quality of local material declined, imported materials would have been used more heavily and selectively. Relatively small amounts of Bangor, fossiliferous Fort Payne, other cherts, and quartzite are found at sites during the Early Archaic primarily in the form of finished tools (Tables 24-26, Appendix III). These tools when whole are small and heavily resharpened. Often only fragments were recovered. The amounts of these exotic materials in the sample units decreases through time. The use of blue-gray Fort Payne exhibits a different pattern. Although blue-gray Fort Payne comprises only 5% of the Early Archaic cherts used for artifacts, its use increases through time to 19% during the Middle Archaic and to 25% during the Late Archaic. Although the amount of blue-gray Fort Payne may be inflated by breakage due to heat alteration, this is still a considerable increase. During the Early Archaic blue-gray Fort Payne was present as utilized flakes, edge retouched tools, and unifacial tools, as well as bifaces. During the Middle and Late Archaic it is present as finished bifacial tools.

TOOL MANUFACTURE

The model for change in lithic assemblages predicts that tool production would have been expedient during the Early Archaic. As sites were more intensively used during the Middle and Late Archaic, efficiency in resource procurement and in their tools would have become more important. Tool production would have required increasing amounts of time and energy to improve tool efficiency. During the Early Archaic it was expected that more edge-retouched tools and utilized flakes than formal unifacial tools or bifacial tools are expected in the Early Archaic data. During the Middle and Late Archaic more extensively shaped tools - bifacial, unifaical, and shaped ground stone, and less utilized or simply retouched pieces are expected in the assemblages.

These expectations are met (Table 27, Appendix III). There is a considerable shift to the use of bifaces during the Middle and Late Archaic. Although bifacial reduction flakes are the products of bifacial reduction, their use as tools is essential expedient. Even the use of these flakes decreases in the Middle Archaic. The difference between the Early Archaic and other time categories would be even greater if all of the utilized flakes from 22It621 had been included in the sample (see Section 2). Shaped ground stone items also increase during the Middle and Late Archaic. Shaped ground stone made up 5% of all the ground stone in the Early Archaic, 12.5% in the Middle Archaic, and 8.3% in the Late Archaic.

Another way to increase tool efficiency is to make tools more complex. Although most tool parts are perishable, the hafting element on stone can be used as a measure of complexity. The model predicts that the percentage of hafted tools would increase during the Middle and Late Archaic (Table 28, Appendix III). Tools with hafting elements increase from 10.2% of those tools on which hafting could be assessed in the Early Archaic to 18.5% in the Middle Archaic. During the Late Archaic 16.3% of the tools have hafting elements.

Although there are more tools with hafting elements in the Middle and Late Archaic, the hafting elements are not necessarily more standardized as it has been argued they should be. The cluster analysis performed on named point types shows that haft length, neck width, and base width are not helpful in defining either morphological types, nor are they particularly sensitive to chronology. The very early Archaic points, however, form tighter clusters. It is possible that hafting elements become less standardized through time. Length, width, and thickness measurements (Table 29, Appendix III) show little evidence for standardization of tools in collapsed technological class categories. The standard deviations do not become significantly smaller in later time periods.

As the need for efficiency increased during the Middle and Late Archaic, and the need for a highly portable multipurpose tool kit would have decreased. The tools are expected to have become more specialized. The number of different functions assigned to whole tools during this analysis can be used to assess the specialized or multipurpose nature of tool kits. There is a statistically significant difference in the numbers of different functions per tool (Tables 30-32, Appendix III). Tools with only one function increase during the Middle Archaic and also, to a lesser extent, during the Late Archaic. This is particularly apparent for Fort Payne chert.

TOOL USE STRATEGIES

When sites are occupied for relatively short periods of time during the Early Archaic, the model for lithic tool use strategies predicts that tools will be expediently used as well as be expediently manufactured. Expediently used tools would have received less use, would have been abandoned before they were broken and would not have been resharpened or reworked.. Since these sites were not occupied for long periods of time, tools also would have been less likely to break through trampling or unintentional heating. As sites were more intensely occupied, during the Middle and Late Archaic, tools would have been more heavily used, resharpened, reworked, and broken (either through use, unintentional heating, or trampling).

The total number of used functional units recorded on whole tools can be used as a measure of intensity of tool use. Analysis of this data (Table 33, Appendix III) indicates that this expectation is not met. The number of tools with no recorded function increases in the later time categories, and total number of functional units when identified remains about the same or decreases through time. Another measure of tool use intensity is the number of "used and still useful" tools left on a site. If tools are not used as intensely, they are more apt to be still useful, at least to the eyes of archaeologist. As seen in Table 130, the precentage of "still useful tools does decline through time from 48.2% in the Early Archaic, to 39.2% in the Middle Archaic, and to 37.8% in the Late Archaic (Table 34, Appendix III). Surprisingly, both resharpening and recycling of tools is low in all time periods, but resharpening does increase from 2.2% in the Early Archaic, to 6.0% in the Middle Archaic, and to 4.1% in the Late Archaic. Recycling declines slightly from 3.6%, to 3.3%, to 2.9%.

Both the percentage of broken tools in assemblages and heat alteration meet the expectations for tool use. The percentage of broken tools increased from 51.9% in the Early Archaic to 63.3% in the Middle Archaic and to 65.2% in the Late Archaic. The amount of unintentional heating or heat alteration also increases (Table 35-38, Appendix III). This increase is slight for local chert but does occur in the finished tool stage. As expected the difference is most noticeable for Fort Payne chert. Finished tools are most often heat altered.

All but two expectations for changes in Early Middle and Late Archaic lithic assemblages have been met. Heat treatment of local raw materials did not increase through time, and one measure of tool use intensity, the total number of functional units, does not increase as expected. In general, it seems that intensity of site use as a function of an increasingly sedendary population does occur during the Middle Archaic. The timing of this change, however, is open to question. Although our expectations were met when site units were collapsed into new time categories, a great deal of variation exists within time categories and sites. Various indicators such as tool and debitage density, and technological and functional diversity suggest that more substantial occupations occurred during time category 2, the early Middle Archaic. The collapsing of study units masks differences that might be very important to interpretations of the Archaic.

CHAPTER IX CERAMIC ANALYSIS

Although the primary focus of this project was a sampling and study of the archaeological remains from the Archaic stage, it also included sampling and study of specific periods of some deposits from post-Archaic occupations in the Upper Tombigbee Valley. These included the Late Gulf Formational Henson Springs horizon component at the Aralia site (22It563), a Middle Woodland Miller II burial mound at the Dogwood site (22Mo531), and Late Woodland/ Mississippian Miller II component at Site 22It606. The results of excavation of these sites is presented in Chapter V, but further study was performed on the ceramic assemblages recovered from these sites and is reported in this chapter.

Preliminary analysis documented that the ceramic assemblage from the Aralia site resulted primarily from a single Late Gulf Formational Henson Springs occupation with minimal earlier or later visits. This single-component assemblage was radiocarbon dated at A.D. 460±50 and is consistent with those previously obtained. This is the only known isolated assemblage recovered in the waterway. All others have been either mixed with later Woodland material or limited to a few isolated features. The uniqueness of this assemblage and its potential for answering research questions suggested a detailed analysis.

In addition, the ceramic assemblage from 22It606 was further studied to provide information on the Late Woodland development into Mississippian stage. It is readily comparable to the better known contemporaneous cultures in the Central Tombigbee Valley. The late dates on this assemblage from this site add to the growing theories that the Upper Tombigbee Valley was either "empty" or continued the Late Woodland tradition until the 12th - 13th century A.D. and was not "Mississippianized" as was the central valley and the nearby Tupelo Hills.

As the ceramic assemblage from the Dogwood Mound was the only *in situ* materials recovered in this project from the Miller II period this, too, was included in the study. These data can be compared to other contemporaneous sites with larger assemblages from midden mound sites.

RESULTS

One of the major results of this study was a detailed type and variety description for the ceramics. These data are contained in Appendix IV and illustrate the following information for each type/variety: count, temper, interior and exterior color, average sherd thickness, surface treatment, manufacturing technique, vessel form breakdown, including diameter and lip and base characteristics.

METHODS AND PROCEDURES

All recovered ceramics, except the eroded specimens from 22It563, from the three sites were included in the sample for the Phase III detailed analysis. To develop the modal analysis system to be used, ceramics from the three sites were retrieved from storage, and all decorated sherds were spread out on large tables. The sherds were first separated into the initial Phase I and II classification types established by Jenkins (1981) based primarily on surface finish, decoration, and temper. These groups were then further segregated into groups of discrete decorative patterns, including technique, design or motif, and placement of design. These categories were further broken down into design elements. Line shape, width, design element association, and portions of the vessel where the design occurred were all included in the design elements.

Classification of shape, decoration or surface finish, and paste was also included. Attribute variables included rim, base, appendages, and overall vessel shape. Paste variables included temper and temper particle size. The ceramic analysis also recorded information on technology and function. The complete code list of ceramic variables and values recorded in this study are presented in Appendix IV, Table 1.

This data set is particularly conducive to descriptive and statistical analysis. The data were entered in a format compatible with the Statistical Analytical System (SAS) software package, which is available and on hand at many institutions and corporations. The data set is permanently stored on tapes which are available from the University of West Florida. The data can then be put on disk for statistical manipulation. SAS User's Guides available in most bookstores are readily available and updated yearly from the SAS Institute, Inc. in Cary, N.C. By using the ceramic attribute and code list presented in Appendix IV Table 1 and SAS software, anyone can query the data set at any time. Some of the descriptive analysis which is particularly useful and informative, for example, is frequency analysis. Tables 132-142 present some of the totals for several attributes such as treatment, decoration, and technology. Appendix IV, Tables 2-5 presents the complete results of the modal analysis organized by ceramic types. A study of some of the relationships of the attributes in a few of the ceramic types follows.

THE HENSON SPRINGS CERAMIC ASSEMBLAGE

THE STUDY AND RESULTS

The modal analysis performed on the ceramic fragments from the Aralia site produced much detailed information which can be used to address many present and future research questions. The integrity and isolation of this assemblage in space and time, provide a base line for future collections.

The study included all sherds identified as decorated in the preliminary analysis. Then all specimens in the residual plain and eroded categories were inspected, and those which had a discernible decoration, and those which could truly be classified as residual plain, were also included in the study. No eroded sherds were included. Although a complete analysis of the data is beyond the scope of this report, some patterning will be described as an example of the kind of studies that can be done with this data set.

From the frequency of the total number of types present in this ceramic assemblage (Table 132), the most abundant types are Alexander Pinched (45%), Alexander Incised (22%), and Residual Plain (29%). A few minority types are present but make up only 5% of the assemblage. Figure 50 graphically illustrates these frequencies. Corroborating the dominance of the Alexander Pinched type. These primary modes of decoration tended to corroborate the dominance of the Alexander Pinched type. Punctation is the primary mode of decoration, with 67% of the sample while incising accounts for only 23% (Table 133). These differences may be accounted for by classification definitions, since the type Alexander Pinched could not include incising, while the type Alexander Incised could contain some pinching elements.

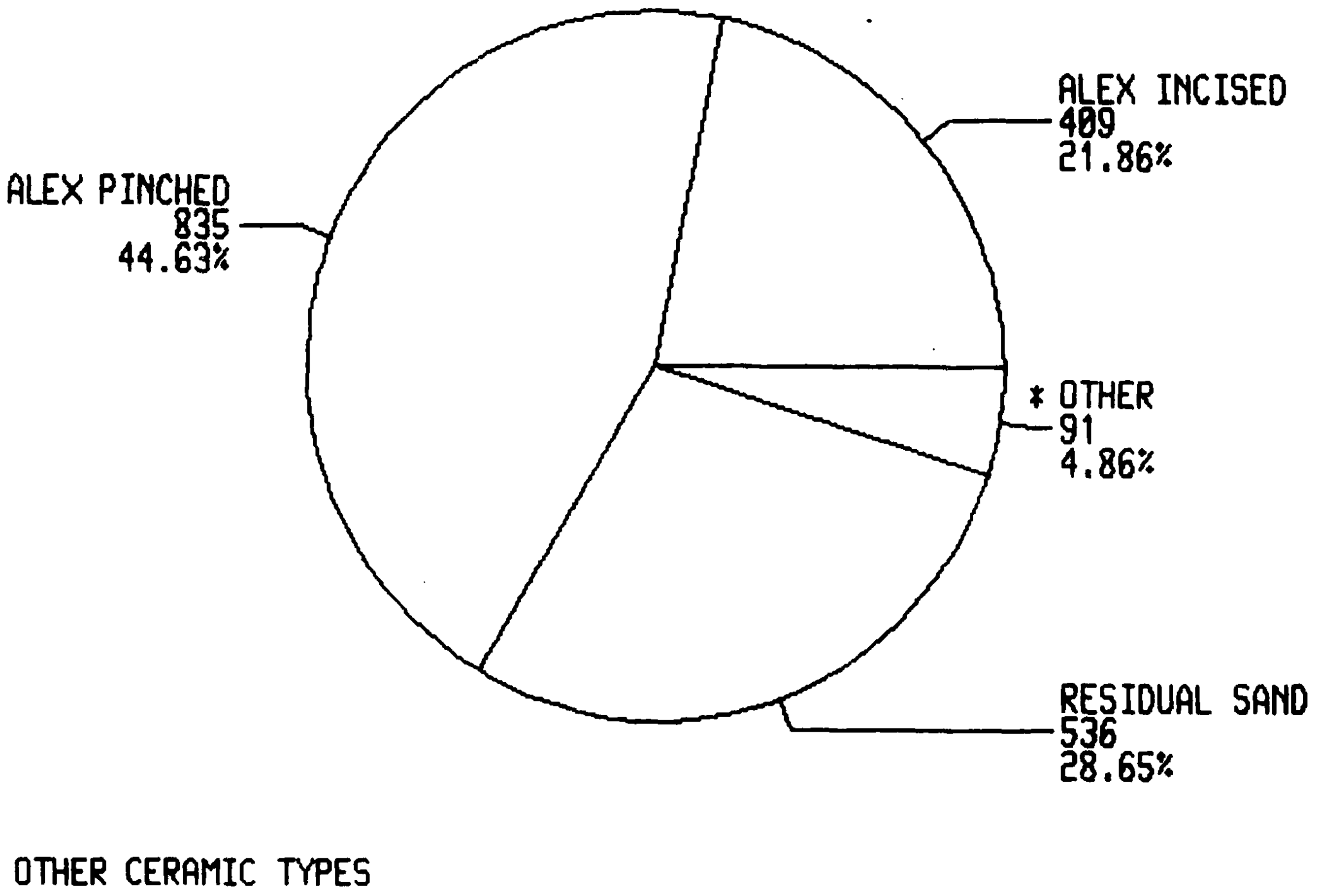


Figure 50 Ceramic types at 22It563.

Table 132
Frequencies of ceramic types.

Type	Frequency	Percentage
Alexander Incised var. Negro Slough (12)	409	21.8
Alexander Pinched var. Prairie Farms (815)	835	44.6
Residual Sand	536	28.6
Columbus Punctate	57	3.0
Crump Punctate	12	0.6
Santa Rosa Stamped	12	0.6
Smithsonia Zoned Punctate	1	0.1
Saltillo Fabric Marked	1	0.1
Eroded Sand	1	0.1
Other	8	0.4
Indeterminate	8	0.4
Total	1,871	

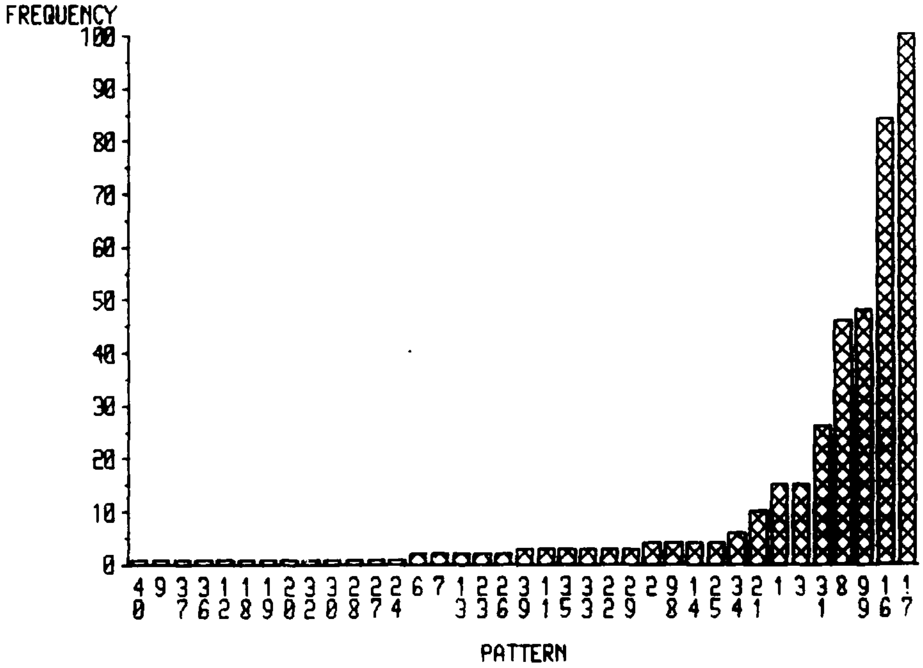
Table 133
Primary method of decoration.

Type	Frequency	Percentage
Punctation	893	67.2
Incising	301	22.6
Complex	129	9.7
Stamping	4	0.3
Indeterminate	1	0.2
Nodes	1	0.2
Total	1,374	

The design element analysis of the ceramics revealed several interesting trends. The patterns of decoration in Alexander Incised are far more varied than the patterns of Alexander Pinched (Table 134 and Figures 51-52). Alexander Incised has 36 different patterns, while Alexander Pinched had only eight. Both types had numerous sherds with indeterminate and unnamed ("other") patterns, however, most Alexander Pinched (96.1%) had indeterminate or no pattern. Alexander Incised had only (11.7%) with no pattern. This is probably related to the ease of pattern determination in the incised versus pinched sherds. In addition, of the 1,043 sherds with a motif that was discernible, the rectilinear design was dominant (93.7%), while only 3.1% were curvilinear, and 3.2% were a combination of rectilinear and curvilinear designs.

Table 134
Frequency of Alexander Pinched and Incised decorative patterns.

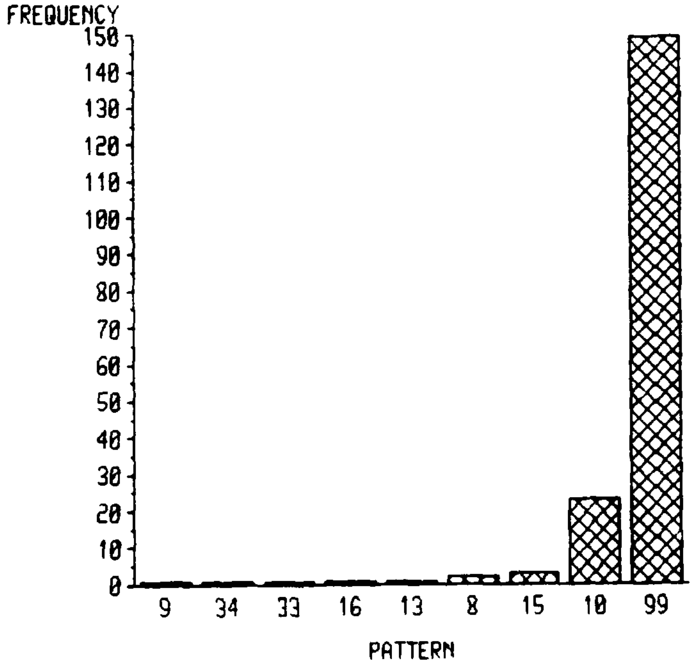
Alexander Pinched Pattern Code		Frequency	Percentage
10	Patterned punctations in two directions	23	2.7
15	Zone of punctations outlined by triangles	3	0.4
8	Zoned punctated	2	0.2
9	Punctations in triangles over horizontal lines	1	0.1
13	Small punctations below horizontal line	1	0.1
16	Parallel lines	1	0.1
33	Fingernail pinches over incised lines	1	0.1
34	Fingernail pinches over crossed incised lines	1	0.1



Patterns:

17	Zoned Incised
16	Parallel Lines
99	Indeterminate
8	Zoned Punctated
31	Only One Line Showing
3	Nested Triangles
1	Cross-Hatched
21	Maze Design Formed Between Two Parallel Lines or a Single Line
34	Fingernail Pinches Where Incised Lines Cross
25	Nested Diamonds or Triangles
14	Dentate Stamped Zoned by Horizontal Lines
98	Other
2	Vertical Parallel Incised From Lip
29	Herringbone
22	Zoned Punctated/Unpunctated Areas
33	Fingernail Pinches Over Incised Lines
35	Fingernail Pinches In Acute Angles Formed When Incised Lines Cross
11	Nested Triangles With Zoned Punctations
39	Crossed Incised Lines
26	Zoned Cross-Hatched In Panels
23	Punctations Over Incisions
13	Small Punctations Below Horizontal Lines
7	Line Filled Triangles
6	Nested Squares
24	Nested Diamonds
27	Zoned Cross-Hatched/Zoned Nested Squares
28	Zoned Maze
30	Parallel Incisions From Lip With Punctations On Top
32	Zoned Punctated (Bar-like)
20	Zoned Cross-Hatching: V's and Double V's Adjacent
19	Nested Triangles Over Parallel Incised Lines
18	One Incised Line Below Rim
12	Punctations Over Horizontal Incised Lines
36	Rows of Pinches and Incised Lines Below
37	Rows of Pinches With Crossed Lines Below
9	Punctations in Triangles Over Horizontal Lines
40	Crossed Incised Lines

Figure 51 Bar chart of patterns of Alexander Incised.



Patterns:

99	Indeterminate
10	Patterned Punctations in Two Directions
15	Zone of Punctations Outlines by Pinches
8	Zoned Punctated
13	Small Punctations Below Horizontal Lines
16	Parallel Lines
33	Fingernail Pinches Over Incised Lines
34	Fingernail Pinches Where Incised Lines Cross
9	Punctations In Triangles Over Horizontal Lines

Figure 52 Bar chart of patterns of Alexander Pinched.

Table 134

Frequency of Alexander Pinched and Incised decorative patterns (continued).

Alexander Pinched

Pattern Code		Frequency	Percentage
98	Indeterminate pattern	149	17.8
	No pattern	653	78.3
Total		835	

Alexander Incised

Pattern Code		Frequency	Percentage
17	Zoned Incised	100	24.4
16	Parallel lines	84	20.5
99	Indeterminate Pattern	48	11.7
8	Zoned punctated	46	11.2
31	Only one line showing	26	6.3
1	Cross hatched	15	3.7
3	Nested triangles	15	3.7
21	Maze design	10	2.4
4	Fingernail pinching where incised lines cross	6	1.5
2	Vertical parallel incised from lip	4	1.0
14	Dentate stamped zoned by horizontal lines	4	1.0
25	Nested triangles or diamonds with zoned punctated and unpunctated area	4	1.0
98	Other	4	1.0
29	Herringbone	3	1.0
11	Nested rectangles with zoned punctations	3	1.0
33	Fingernail pinching over incised lines	3	0.7
35	Fingernail pinching at the intersection of acute lines	3	0.7
39	Crossed lines	3	0.7
22	Zoned punctated and unpunctated areas	3	0.7
23	Punctations over incisions	2	0.5
13	Small punctations below horizontal lines	2	1.0
6	Nested Squares	2	0.5
7	Line filled triangles	2	0.5
26	Zoned cross-hatched with zoned maze panels alternating one above the other	2	0.5
99	No Pattern	2	
30	Parallel incised from lip with fingernail punctations	1	0.2
12	Punctations over horizontal lines	1	0.2
2	Zoned punctated with unpunctated zones	1	0.2
9	Puctations in triangles over horizontal lines	1	0.2
18	One incised line below lip	1	0.2
19	Nested triangles over parallel lines	1	0.2
20	Zoned cross hatching	1	0.2
24	Nested diamonds with zones punctated and unpunctated areas	1	0.2
27	Zoned cross-hatched with nested squares	1	0.2
28	Zoned maze decorations with punctations over parallel incised lines (Crump Punctate)	1	0.2
32	Zoned bar-like punctations	1	0.2

Table 134
Frequency of Alexander Pinched and Incised decorative patterns (continued).

Alexander Incised Pattern Code		Frequency	Percentage
36	Rows of pinching around lip bordered by incisions	1	0.2
38	Rows of pinching around vessel with crossed lines below	1	0.2
40	Round punctations bordering incised line	1	0.2
Total		409	

Although the number or patterns identified in the Alexander Pinched type is low (eight), the most frequent pattern is "Punctations in Two Directions." This pattern contains 23 specimens and makes up 66.7% of the patterned specimens. The other seven patterns contain three or fewer specimens. The large number of indeterminate and no pattern identified above could well be related to small sherd size and the tendency for decorative patterns of punctating to be large (Jenkins 1981:119). In small sherds, these patterns would not be identified. In the larger sherds recovered and/or refitted in this assemblage, the decorative pattern included either the entire vessel, or the upper half. This problem is reflected in the results of the analysis of the arrangement of punctations and pinches of Alexander Pinched type (Table 135), which revealed that 95.4% are patterned in some manner as opposed to random (1.8%), or a combination of random and patterned (2.5%).

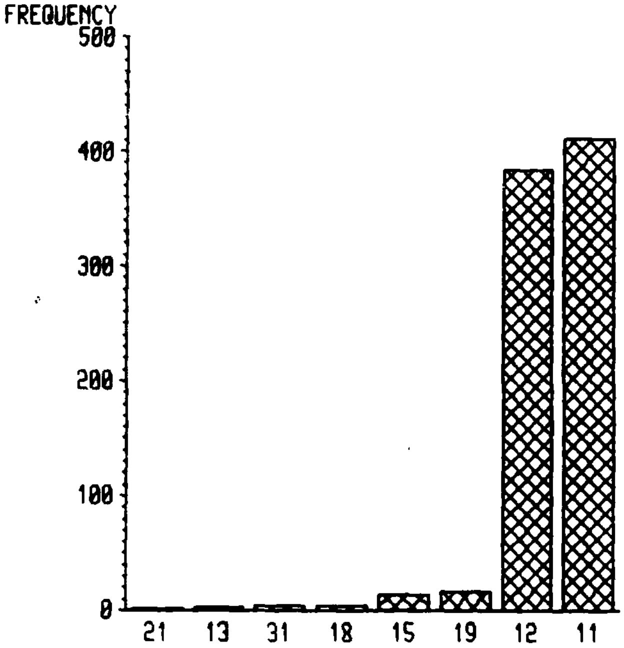
Table 135
Arrangement of punctations and pinches in ceramic type: Alexander Pinched.

Type	Frequency	Percentage
Patterned	682	95.4
Other	18	2.5
Random	13	1.8
Combination	2	0.3
Total	751	

The method of making the punctations was also studied, and the results are presented in the bar chart in Figure 53 and Table 136. The most dominant modes are Fingernail Punctated (45.9%) and Fingernail Pinched (43.8%), with Hemicoidal, Indeterminate, and Other making up the remaining 11.2%.

Table 136
Design analysis.

Design Type	Frequency	Percentage
Incising		
U-shaped	202	67.3
V-shaped	49	16.3
Indeterminate	33	11.0
Square	10	3.3
Combination	2	0.7
Other	1	0.3
Subtotal	300	



Modes of Punctation:

11	Fingernail Punctated
12	Fingernail Pinched
19	Indeterminate
15	Pinched and Punctated
18	Other
31	Incised and Punctated/Pinched
13	Hemicoidal
21	Dentate

Figure 53 Bar chart of mode of punctation of ceramic type Alexander Pinched.

Table 136
Design analysis (continued).

Design Type	Frequency	Percentage
Punctation		
Fingernail Punctate	412	45.9
Fingernail Pinched	383	43.8
Hemicoidal	56	6.2
Indeterminate	20	2.2
Pinched and Punctated	13	1.4
Other	13	1.4
Subtotal	905	
Stamping		
Dentate	1	33.3
Plain rocker	2	66.6
Subtotal	3	
Combination		
Incising/Punctation/Pinching	125	94.0
Incised and Stamped	5	3.8
Stamped and Punctated	1	0.8
Other	1	0.8
Subtotal	132	
Total	1,329	

The frequency analysis of the decorative patterns identified within the Alexander Incised type is presented in Table 133 and graphically illustrated in Figure 51. This analysis reveals that the dominant Alexander Incised patterns are Zoned Incised (24.4%), Parallel Lines (20.5%), and Zoned Punctated (11.7%). Indeterminable patterns also make up 11.2% of the sherds. The remaining 32.3% of the Alexander Incised sherds are split between 32 different patterns, the highest of which had only 6.3% of the total, with a frequency of 26, whereas the others are represented by fewer than ten specimens each. Two factors which probably effect this wide range are the relative small size of the specimens and the complexity of partial designs on a sherd being classified. In a detailed modal analysis of design elements such as this, there may well be separate portions of the same design classified as two patterns. However, this is a necessary first step in unravelling the complex decorations of the Alexander Incised ceramics. The complexity of the decorations of this Henson Springs assemblage is also reflected in the 125 specimens that have a combination of decorative modes (Table 136).

Also included in this study was a classification of the method of incising (Table 136). This revealed that 67.3% of the 300 specimens with incised lines were U-shaped, 16.3% were V-shaped, and 3.3% were square-shaped in cross-section.

The study of the methods of lip modification revealed that most (65.3%) are undecorated (Table 137). Of the decorated specimens, the most frequently encountered is nicking (17.8%), however, almost as many specimens with an indeterminate decoration (15.9%) were studied. Rims are predominately folded (92.3%) and round in cross-section (72%). Pointed and flat cross-sections were present, but low in frequency (28%).

Table 137
Rim and lip modification.

Modification Type	Frequency	Percentage
DECORATION		
Nicked	47	17.8
Cord Marked	1	0.4
None	172	65.3
Other	2	0.8
Indeterminate	42	15.9
Total	264	
LIP CROSS-SECTION		
Unfolded		
Flat	28	
Pointed	38	
Round	175	
Subtotal	244	92.3
Folded		
Flat	1	
Pointed	6	
Round	13	
Subtotal	20	7.7
Total	261	

This analysis also addressed overall vessel shape, profile, and base shape, in addition to the lip and rim traits noted above. Unfortunately, only 24 specimens are large enough to determine the overall shape (Table 138). Most (58.3%) of the vessels were bowls; 10 simple, one each of restricted, conoidal, flared, and restricted conoidal bowl. Also present are eight beakers, all of the Alexander Pinched type. These shapes include six regular beaker-shaped, one each with a globular base and a barrel shaped. Also included in the ceramic assemblage is one boat-shaped vessel and one recurvate globular jar.

Table 138
Overall shape.

Shape Type	Frequency
Simple Bowl	10
Beakers	
Regular	6
Barrel Shaped	1
Globular Base	1
Conoidal Bowl	1
Flared Rim Conoidal Bowl	1
Restricted Simple Bowl	1
Boat-shaped	1
Recurvate Globular Jar	1
Restricted Bowl	1
Total	24

In an effort to determine the kind of vessel types in this ceramic assemblage the vessel profiles of all possible sherds were recorded. This revealed that most vessels had excurvate (61.9%) or vertical (25.6%) profiles and are probably bowls (Table 139). Incurvate profiles were identified from 10.2% of the specimens, and these were probably jars. Peaked profiles were also identified on 3.3% of the specimens. Following Halley's interpretation of vessel function and site function (Halley 1985), it appears that most of the activities conducted at this site involving ceramic containers was with cooking and eating and that storage ceramic containers (jars) were not frequently utilized. This, in turn, supports the interpretation of site use as a short-term campsite.

This study also investigated the possibility of patterned association of ceramic types with vessel profiles (Table 139). This revealed that the bowls (excurvate and vertical profiles) were primarily dominated by Alexander Pinched. However, the jars were decorated fairly evenly with Alexander Incised and Alexander Pinched. Peaked rims were dominated by Alexander Incised. Although the interpretive function of this profile is unknown, it probably reflects eating or drinking containers rather than storage.

Table 139
Vessel profiles by ceramic type.

Ceramic Type	Excurvate	Vertical	Incurvate	Peaked	Total
Alexander Incised	42	12	10	5	69 (28.3%)
Alexander Pinched	82	28	9	2	121 (49.6%)
Columbus Punctate	2	1	1	0	4 (1.6%)
Crump Punctate	5	0	0	0	5 (2.0%)
Residual Plain	19	18	5	1	43 (17.6%)
Other	1	0	0	0	1 (0.4%)
Indeterminate	0	1	0	0	1 (0.4%)
Total	151 (61.9%)	60 (25.6%)	25 (10.2%)	8 (3.3%)	244

One of the diagnostic vessel attributes of Early Woodland and Late Gulf Formational ceramics is base shape. In this assemblage, base shape was determinable on 111 specimens (Table 140). Podal supports are present on 104 bases, one has an annular ring, and five have a flat base. The number of podal supports is determinable on only two vessels. One has four, and one has three. In Table 140 shows the 45 determinable shapes: 83.2% are teat-shaped and three (2.9%) specimens are wedge and annular shaped.

Table 140
Basal attributes.

General Shape	Frequency	Percentage
Flat	5	4.0
Podal Supports	104	83.2
Annular Ring	1	0.8
Indeterminate	15	12.0
Total	125	

Shape of Podal Supports	Frequency	Percentage
Teat	34	32.7
Wedge	3	2.9
Annular	3	2.9
Indeterminate	64	61.7
Total	104	

In summary, The modal attribute study of this Alexander assemblage has resulted in much new information, some of which has already been described. The decoration, in general, is characterized by the dominance of pinched over incised types and rectilinear over curvilinear motifs. The modal pattern analysis revealed that little patterning is discernible in the pinched/punctated specimens, and only five patterns dominate the incised specimens. The incised patterns also cover a much wider range than the pinched. Rim attribute analysis shows that most were undecorated, folded, and round in cross-section. Although few overall vessel shapes are discernible in this particular assemblage, all but one are bowls. This characteristic agrees well with the dominance of excurvate and vertical rim profiles over incurvate. Podal supports are the most common identified form of base treatment.

There are many other aspects of this isolated Alexander assemblage that can be studied by future researchers. These include the manufacturing and firing techniques used to make the vessels, refitting studies to increase the number of identifiable vessel shapes, and the location and association of different decorative elements on the vessel surface. However, the frequency analyses presented here is compatible with that of other researchers, and it is anticipated that it hopefully can be used directly in comparative studies.

INTEGRATION OF THE RESULTS

Recently, several large Henson Springs components have been excavated, and, together with the Aralia site data, they can shed some light on the development of this culture. A seriation of the major ceramic types from these sites has revealed several developmental trends of the Alexander series ceramics (Table 142). First, larger percentages of fingernail punctated or pinched pottery classified as "Alexander Pinched" occurred early. Second, although podal supports span the entire period, rim bosses appeared fairly late. Finally, the Alexander Incised was dominant during the later portion of the phase.

TABLE 142
Decorated ceramics from major Alexander components.

Type	Aralia	Kellogg	Yarborough	Turtle Pond	1Gr2
Alexander Incised	409 (22%)	134 (62%)	560 (51%)	91 (44%)	107 (69%)
Alexander Pinched	835 (45%)	30 (14%)	490 (44%)	118 (56%)	48(31%)
Columbus Punctate	57 (3%)	47 (21%)	14 (1%)		
Crump Punctate	12 (0.1%)		38 (3%)		
Mandeville Stamped		3 (1%)			
Santa Rosa Stamped	1 (0.1%)				
Smithsonia Zone Stamped		2 (1%)	2 (0.5%)		
Saltillo Fabric Marked	1 (0.1%)				
Total	1,200	216	1,104	209	155
Podal Supports	P	P	P	A	A
Rim Bosses	A	P	A	A	P

Only decorated ceramics were included in this seriation, since the plain body sherds associated with the Alexander series are not sufficiently distinct from those of the later Miller I and II ceramic complexes. At the Aralia site, however, most plain body sherds were probably included in the eroded category. Therefore, only the diagnostic Alexander categories were included in the seriation. Other studies have shown that the percentage of Plain in Alexander assemblages may increase through time (Thomas et al. 1982, Table 2).

The Aralia site appears to be the largest and earliest known site of the Henson Springs horizon in the Tombigbee Valley. The ceramic assemblage contains the second highest amount of Alexander Pinched (45%) of any other site in the seriation, second only to the proximate Turtle Pond site. Although a greater number of Alexander sherds were collected from Aralia than any Henson Springs site yet excavated, the Yarborough site has produced a greater number of Alexander Incised sherds. There is, however, greater morphological variability at Aralia than at Yarborough. Only three varieties of Alexander Incised (each defined by distinct decorative modes) were recognized in the 560 specimens of that type found at the Yarborough site (Solis and Walling 1982:84-86), while at Aralia 36 distinct decorative modes were observed (Table 143). This may indicate an inverse relationship between the increasing percentages of incised decorative treatment and decrease in the variability.

One distinctive feature of Alexander pottery - the rim boss - is completely absent at the Aralia site. The absence of rim bosses seems to coincide temporally with larger percentages of pinching during early Alexander manufacture, which tends to support an early time period for the Aralia site (Figure 53). Another minority variety present at Aralia is Columbus Punctate (3%). Although this type comprises 21% of the decorated Henson Springs assemblage at the Kellogg site, it appears late in the series because of the presence of a large amount of Alexander Incised, which outnumbers Alexander Pinched at that site four to one. However, a feature (136) at that site dated 760±70 B.C. contained primarily pinched pottery (Atkinson et al. 1980:233). This date is not consistent with seriation, and it seems that there was a small earlier Henson Springs component present at Kellogg from which the Columbus Punctate was derived. Columbus Punctate is similar to the earlier type Wheeler Punctate and is likely a lineal development.

TABLE 143
Summary ceramics at 22Mo531.

Type	Frequency
Sand Tempered	
Saltillo Fabric-Marked, variety unspecified	13
Saltillo Fabric-Marked, variety Tombigbee	16
Saltillo Fabric-Marked, variety China Bluff	15
Subtotal	44
Furrs Cord-Marked, variety unspecified	8
Subtotal	8
Total, Sand Tempered	52
Limestone Tempered	
Mulberry Creek Plain, variety unspecified	6
Subtotal	6
Total Ceramics	58

The Henson Springs ceramic assemblage at the Aralia site has primary value because it is a single component site which allows reliable calculations of ceramic types, frequencies, varieties, and attributes of the Alexander ceramics complex. The recovered assemblage is also large which, adds credibility to the range of types present. The radiocarbon date of 460 B.P. documents this occupation within the early portion of the Henson Springs period and confirms the sequence of the ceramic assemblages.

The Turtle Pond site, also on the edge of the floodplain, is a Henson Springs site only 2 km (1.3 mi) south of Aralia with stratified Alexander ceramics. There is some vertical mixing of components, but apparently, the ceramic assemblage at the Turtle Pond probably dates toward the earlier portion of the phase, since pinching outnumbers incising by 56% to 44%. It is difficult to determine from the published ceramic analysis and discussion if rim bosses or podal supports were present (Thomas et al. 1982). It is evident that the relative frequency of Baldwin Plain (Plain sand-tempered pottery) increases through time. Most levels, however, had significant amounts of diagnostic Miller I pottery, indicating that an unknown portion of the Plain sand-tempered pottery is Miller I (Thomas 1982, Table 2, Figure 2.1).

The Yarborough site is 65 km (40 mi) downstream from the Aralia near Columbus, Ms and is the second largest Henson Springs site excavated in the Tombigbee Valley. Unfortunately, most of the Henson Springs ceramic assemblage was mixed with later components. However, pieces are probably from the middle of the Henson Springs phase, since the Alexander series ceramics consisted of approximately 51% incised and 44% pinched pottery. Rim bosses do not seem to be present in this assemblage.

Of special interest at the Yarborough site was the recovery of one sherd of St. Johns Incised. Bullen (1969:41) assigns this type to the Transitional Period (1,000-300 B.C.) of Florida (Solis and Walling 1982). Both Alexander Incised and Tchefuncte Incised appear to be copies of St. Johns Incised decoration (Walthall and Jenkins 1976).

The Kellogg site, also near Columbus, Ms is another example of a disturbed Henson Springs component. This site, however, contained several features with diagnostic series Alexander ceramics. Two features each yielded a restorable vessel piece. One was a straight-sided vessel of Alexander Incised with six podal supports which lack rim bosses (Atkinson et al. 1980, Figure 13). This feature also yielded a radiocarbon date of 760±70 B.C. Considering the ceramic sample from this feature (seven Alexander Pinched, one Alexander Incised, and two Plain sherds), the date appears to be at least 100 years too early.

The majority of the Henson Springs assemblage from this site seriates late in the Henson Springs ceramic sequence. Alexander Incised comprised 62% of the assemblage, while Alexander Pinched comprised only 14%. Rim bosses and podal supports were both present (Table 142).

Site 1Gr2 is the smallest of the Henson Springs components considered in this discussion. While the midden had been badly disturbed by later occupations, there were a few features recovered which could be definitely attributed to this occupation. This occupation seriates late as indicated by the fact that 69% of the assemblage is incised and only 31% is pinched. Rim bosses and podal supports are both present (Jenkins 1981:55) (Table 142).

The finely executed and diagnostic Alexander series ceramics in the Western Tennessee Valley and the Central and Upper Tombigbee Valley has been an enigma to most archaeologists in the Southeast. Adding to the problem has been the impression of an abrupt emergence and decline. The chronological placement of the ceramics was initially 500 B.C. (Jenkins 1975; Jenkins et al.

1975) was initially met with resistance, since the proposed origin of this ceramic series even included the Ohio Hopewellian florescence (ca. 100 B.C. - A.D. 200), and similarities do exist between Alexander and classic Hopewellian ceramic styles. In addition, similarities exist between Weeden Island (ca. A.D. 400-1,000) and the Alexander ceramic decorations.

Information retrieved from excavation and research associated with the Tennessee-Tombigbee Waterway documented that the Alexander ceramic series first developed ca. 500 B.C. and is a part of the development of the Gulf Ceramic Tradition, which existed from 2,500 B.C. until the Historic stage. This tradition developed in the Gulf Coastal Plain physiographic province, south of the fall-line. This tradition includes the consistent recurrence of several decorative ceramic treatments, including incising, punctating, fingernail pinching, and rocker and dentate shell stamping. Coastal Plain vessel modes, with a more limited temporal duration, include podal supports and rim bosses.

The Henson Springs Alexander series ceramics can be understood within the context of a very long ceramic tradition, which existed in the Coastal Plain for the previous 2,000 years. This tradition persisted until historic times, although it was influenced with later ceramic transitions which intruded into the Gulf Coastal Plain. The Alexander ceramic series is a combination of modes from previously existing and contemporary Coastal Plain ceramic complexes. The following discussion briefly outlines this development of Alexander ceramics, the development and evolution of earlier Coastal Plain ceramic complexes, and the relationship of those developments to the Alexander series.

Gulf Tradition ceramics first appeared in the Gulf Coastal Plain region, along the south Atlantic Coast, as early as 2,500 B.C., in the form of the fiber-tempered Stallings Island and Orange series. Although these series generally are distinct, both are characterized by incising and punctating. Between 1,200-500 B.C. the decorative treatments and motifs found in these early series began to spread westward across the Gulf Coastal Plain. They occurred in differing combinations, both spatially and temporally. Between 700-500 B.C. shell stamping, rocker-stamping and dentate stamping, occurred first in the Gulf Coastal Plain. Plain rocker-stamping was centered in the Tchefuncte series of the lower Mississippi Valley, while dentate stamping was located the the Bayou la Batre complex of the Lower Tombigbee Valley and Mobile Bay regions. Dentate stamping also occurred in the Late Wheeler complex along the Central and Upper Tombigbee Valleys and in the western Middle Tennessee Valley.

Although Wheeler Dentate Stamped and Bayou la Batre Stamped are similar visually, their methods of application are different. Bayou la Batre Stamped was applied with a cut scallop shell with five or six crenulations (2-4 cm or .8-1.6 in wide), while Wheeler Dentate Stamped was applied with a straight serrated comb-like device 3-4 cm (1.2-1.6 in) long. Wheeler Dentate Stamped and Bayou la Batre Stamped possibly are historically related, i.e., one may have developed from the other. There are no direct associations to support such a development, but there is some conjectural evidence, i.e. 1) the types are morphologically similar, 2) they are centered along the Tombigbee Valley, 3) Wheeler groups derived much of their raw lithic material, Tallahatta quartzite, from the Bayou la Batre area, and 4) both types seem to be contemporary, though one may be earlier than the other.

West of the Tombigbee Valley a Late Wheeler complex did not develop. The lower Mississippi Valley area seems to have been a melting pot for ceramic development between 1,200-700 B.C. The Poverty Point trade network was probably an important factor in this ferment. Approximately 700 or 800 B.C., an early Tchefuncte complex, known as Tchula, developed out of the Wheeler complex in southern Mississippi. This complex was comprised of rectilinear incised decorative elements from the previous St. Johns complex in Florida and the drag-and-jab incised decorative treatment of the Stallings Island complex in Georgia. Simple stamping and punctation were carried over from the earlier Wheeler complex. Rocker stamping was introduced at this time. The source of rocker stamping is unclear, but a likely candidate is the Bayou la Batre complex of the Mobile Bay area.

At approximately the same time that the Tchefuncte phase was developing or slightly later ca. 500-600 B.C., the Alexander ceramic complex also made its first appearance. Alexander ceramics are both similar to and different from Tchefuncte. Tchefuncte ceramics probably first occurred ca. 700-800 B.C. The Alexander series appear to have developed out of a late Wheeler complex (ca. 500-600 B.C.). These chronological differences cause some discrepancies in the appearance of certain ceramic traits. Both Alexander and Tchefuncte ceramics are characterized by rectilinear incised decorations throughout their existence. Those that are characterized by hemicoidal punctation derived from the earlier Wheeler complex. This decorative treatment is most prevalent in both early Tchefuncte and early Alexander ceramics. The Alexander and Tchefuncte ceramics are also both characterized by fingernail pinching. However, fingernail pinching is most prevalent early in Alexander and late in Tchefuncte. Both are characterized by rim bosses, but they occur early in the Tchefuncte (ca. 700-800 B.C.), but late in Alexander (ca. 300-100 B.C.). Podal supports also occur in both Alexander and Tchefuncte ceramics, but they are late in Tchefuncte and early Alexander (ca. 500 B.C.). Rocker stamping, most prevalent in late Tchefuncte, never was adopted by Alexander potters.

The Aralia site probably dates fairly early in the Alexander ceramic sequence as Columbus Punctate comprises approximately 3% of the assemblage, and it is very similar to its predecessor, Wheeler Punctate. Pinching outnumbers incising at Aralia by two to one, podal supports are present, and rim bosses are absent. Radiocarbon dates of 429±50 B.C. and 543±50 B.C. indicate an approximate placement of around 500 B.C. for this complex. These dates are somewhat complemented by the 760±70 B.C. date for a similar ceramic assemblage at the Kellogg site, but this date is probably at least 100 years too old.

The Alexander ceramic series disappeared from the Tombigbee and adjacent Tennessee Valley by approximately 100 B.C. In its place the Miller ceramic series, part of the Woodland tradition appeared. These ceramics developed south of the fall-line, within the Coastal Plain prior to 100 B.C. Participation in the Gulf Ceramic Tradition terminated at this time in the Upper Tombigbee Valley. Cord-marking and fabric-marking, hallmarks of the Woodland Tradition, originated inland from the fall-line in an area bounded on the north by the State of New York (Ritchie 1965) and eastern Canada and to the south by the Upper Tennessee drainage (Lafferty 1978).

The ceramics from the Dogwood Mound were included in the modal analysis study conducted in Phase III. Although the sample is small (58 sherds), this was the only in situ Middle Woodland assemblage recovered in this project. In addition, it was the only sample from a burial mound context recovered in all the waterway investigations.

The small sample size, limited the information which could be obtained from the ceramic analysis. However, the results indicate that the fill of the mound contained ceramics typical of this cultural period and reflect the replacement of the Henson Springs ceramic tradition with those of the north (Table 142).

Sand tempering is still dominant, however a small amount of limestone tempering is now present. Surface treatment is much different and is either fabric or cord marked. This tradition of surface treatment continues throughout the Woodland stage in the Upper Tombigbee Valley.

These Middle Woodland ceramics have been recovered from all sites investigated in this project and many other sites investigated by others in the waterway (Bense 1983a; Thomas et al. 1982; O'Hear and Conn 1977), and they reveal a strong human presence in the valley during this period. Several ceremonial sites, such as the Pharr Mounds, of this period also have been documented in the valley. It is unfortunate that the deposits of this period have been mixed in the investigated project sites.

The last assemblage of ceramics included in the Phase III study were from the Late Woodland component at Site 22It606. These ceramics were from feature context, and like those from the Dogwood Mound, represent the only in situ assemblage from this time period recovered in this project. The results of this analysis are presented in Table 144 and 145 and reveal that the tempering has changed from a dominance of sand to that of grog (59.9%), with minor amounts of shell tempering (19.2%), bone tempering (15.4%), and a mixture of the three (5.0%). Surface treatment is usually plain (43.0%), or cord marked (42.3%), with small amounts of incising and brushing (0.7%). These traits reflect both the persistence of the Woodland tradition and the new influences of the Mississippian tradition. The dates on this assemblage range from A.D. 1,090±60 to 1,538±50. This indicates that these ceramics were made at the site and deposited throughout the Late Woodland and Mississippian periods. One of the more interesting areas for future research with the data available from this ceramic analysis is frequency analysis of the contents of each pit. A pit seriation could then be done and a more refined chronology of the ceramic assemblage of these periods could be produced.

TABLE 144
Summary grog- and bone-tempered ceramics at 22It606.

Type	Frequency	Percentage
Baytown Plain, variety Roper	77	13.29
Baytown Plain, variety Tishomingo	154	26.59
Turkey Paw Plain, variety Turkey Paw	18	3.10
Subtotal, Plain	249	42.98
Mulberry Creek Cord-Marked, variety unspecified	255	38.86
Turkey Paw Cord-Marked, variety Moon Lake	101	17.44
Subtotal, Cord-Marked	326	56.30
Alligator Incised, variety unspecified	3	0.51
Solomon Brushed, variety Solomon	1	0.17
Subtotal, Other	4	0.68
Total	576	

TABLE 145
Ceramic totals at 22It606.

Type	Frequency	Percentage by temper	Percentage of Total
Shell Tempered			
Mississippi Plain, variety Warrior	118	79.1	15.3
Bell Plain, variety Hale	17	11.4	2.2
McKee Island Cord-Marked, variety unspecified	1	0.6	0.1
Eroded	13	8.7	1.6
Subtotal	149	100.0	19.2
Mixed Shell and Grog Tempered			
Mississippi Plain, variety Hull Lake	24	61.5	3.1
Bell Plain, variety Big Sandy	15	38.4	1.9
Subtotal	39	100.0	5.0
Grog Tempered			
Baytown Plain, variety Roper	77	16.6	10.0
Baytown Plain, variety Tishomingo	154	33.3	20.0
Mulberry Creek Cord-Marked, variety unspecified	225	48.7	29.2
Alligator Incised, variety unspecified	3	1.0	0.6
Salomon Brushed, variety Salomon	1	0.2	0.1
Subtotal	462	100.0	59.9
Bone Tempered			
Turkey Paw Plain, variety Turkey Paw	18	15.1	2.3
Turkey Paw Cord-Marked, variety Moon Lake	101	84.8	13.1
Subtotal	119	100.0	15.4
Total	769		100.0

SUMMARY

The ceramic attribute analysis performed in Phase III of this project has produced much new and useful information on the nature of the ceramic assemblages in the Upper Tombigbee Valley during the Henson Springs, Miller II, and Miller III horizons. Although a complete analysis of the information is beyond the scope of this project, a sample modal analysis was done with the Henson Springs assemblage data. This has provided base line information on design elements, vessel shape, function, and patterns in the combination of these traits. This information can now be used as a basis of comparison for other assemblages, both in the Tombigbee drainage and elsewhere.

The information produced in the analysis of the Middle Woodland ceramic assemblage is limited by small sample size, but it does document the cultural affiliation of the mound. This information can now be used in the ceramic studies of this period.

The information produced in the analysis of the Late Woodland/ Mississippian assemblage was not analyzed in this project beyond a basic frequency analysis of temper and types. Much more information can and should be gained from the data.

CHAPTER X SUMMARY OF RESULTS

This chapter is designed to summarize the archaeological information produced in this study and to synthesize the results of various study elements as they pertain to the investigatory hypotheses. These results provide the essential ingredients to develop a second-stage model of the adaptive systems practiced during the Archaic stage of occupance in the Upper Tombigbee Valley. In addition, recommendations are advanced concerning future directions.

The research design was refined at each phase of the seven-year project, with the addition of new information and ideas. Throughout, however, the original goal of understanding the processes and causes of cultural adaptations during the Archaic in the Upper Tombigbee Valley remained. The acquisition of new data and the intensity of analysis led to goal modification and changes in hypotheses to be tested.

The investigations centered on two primary areas of study: paleoenvironment and culture. The cultural study focused on preserved material assemblages, site settlement pattern, site use, and subsistence. The paleoenvironmental study assessed climatic change, biotic developments, and landscape evolution.

SUMMARY OF ARCHAEOLOGICAL INFORMATION

Eleven sites in the Upper Tombigbee Valley were investigated in this project. Three sites (all midden mounds) were intensively excavated, and large samples of all cultural deposits were obtained (Poplar: 22It576; Walnut: 22It539; and Ilex: 22It590). Four sites were less intensively excavated (Hickory: 22It621; Beech/Oak: 22It632/22It624; Aralia: 22It563; and Site 22It606), and samples of selected components were obtained, but all components present were not sampled. Three additional sites were only tested (Smilax: 22Mo675; Mud Creek: 22It622; and the Dogwood Mound: 22Mo531) and further work on these sites was recommended.

A total of 530,787 counted specimens and 2,425.7 kg of weighed material was recovered from the 11 sites investigated (Table 146). The number of recovered features totalled 359. Forty-five radiocarbon and 18 archaeomagnetic samples were submitted for radiometric determination.

The three intensively excavated sites produced most of the recovered material and features: 73.8% of all counted material, 40.2% of the introduced rock, and 70.8% of all features. These acquisitions reflect both the higher level of excavation effort and the higher density of material at these sites. The sites were on isolated, well-drained elevations in the wet floodplain with similar configurations and physiographic positions. The Ilex site was only recently separated from the valley wall, whereas the Walnut and Poplar sites were well within the floodplain of the Tombigbee Valley.

The Poplar site produced the most material amounting to 15% more than recovered from the Walnut site and 34% more than that from the Ilex site.

The ceramic assemblages from these three large excavations are generally similar in the proportion of temper types, but do exhibit some differences. The largest single assemblage is from the Poplar site, which has three times more ceramics than the other two sites. The main differences between the assemblages are more sand- and fiber-tempered ceramics at Ilex and more grog-, shell-, and bone-tempered ceramics at the Walnut site. This probably reflects more use of the Poplar site during the late Gulf Formational and Middle Woodland periods and more use of the Walnut site during the Late Woodland period.

TABLE 145
Summary totals of all counted and weighed materials and tested only features by site.

Materials	22It576	22It539	22It590	22It621	22It623/624	22It563	22It606	22It622	22Mo675	22Mo531	Total
Ceramics											
Shell	1,305 (8.0)	461 (8.8)	117 (1.9)	3 (0.1)	22 (0.6)	0	202 (11.7)	0	0	0	
Shell-Grog	363 (2.3)	137 (2.6)	26 (0.4)	0	0	0	0	0	1 (1.3)	0	
Grog	1,920 (11.8)	1,305 (25.0)	329 (5.5)	36 (0.6)	426 (13.2)	47 (1.5)	654 (37.8)	6 (14.6)	18 (23.1)	0	
Bone	207 (1.3)	75 (1.4)	29 (0.5)	2 (0.1)	22 (0.7)	0	37 (2.1)	0	0	0	
Limestone	1,501 (9.2)	367 (5.1)	300 (5.0)	133 (2.2)	295 (8.1)	9 (0.3)	57 (3.3)	0	1 (1.3)	10	
Sand	8,638 (53.0)	2,269 (43.5)	3,969 (66.2)	4,886 (81.5)	2,466 (67.1)	2,976 (97.9)	780 (45.1)	3 (2.4)	57 (73.1)	296	
Fiber	2,355 (14.5)	706 (13.5)	1,225 (20.4)	937 (15.6)	433 (12.1)	9 (0.3)	0	32 (78.0)	1	0	
Total	16,289 (34.4)	5,220 (12.3)	5,995 (14.1)	5,997 (14.2)	3,674 (8.7)	3,041 (7.2)	1,730 (4.1)	41 (0.1)	78 (0.2)	306 (0.7)	42,371 (8.0)
Lithics											
PPK's	1,176 (23.1)	626 (10.1)	1,067 (21.1)	476 (32.4)	765 (30.2)	293 (30.4)	75 (16.4)	66 (21.9)	9 (37.5)	7 (18.4)	
Cores	40 (0.8)	99 (1.6)	237 (4.7)	44 (3.0)	30 (1.2)	15 (1.6)	1 (0.2)	5 (1.7)	1 (4.2)	5 (13.5)	
Bifaces	238 (4.7)	209 (3.4)	236 (4.7)	152 (10.3)	273 (10.8)	64 (6.7)	39 (8.5)	26 (8.5)	1 (4.2)	1 (2.7)	
Preforms	192 (3.8)	190 (3.1)	458 (9.9)	65 (4.4)	48 (1.9)	91 (9.5)	1 (0.2)	33 (11.0)	2 (8.4)	2 (5.4)	
Drills, Perf.	348 (6.8)	292 (4.7)	191 (3.8)	105 (7.1)	192 (7.6)	46 (4.8)	7 (1.5)	8 (2.7)	3 (12.5)	0	

TABLE 145

Summary totals of all counted and weighed materials and tested only features by site (continued).

Materials	22It576	22It539	22It590	22It621	22It623/624	22It563	22It606	22It622	22Mo675	22Mo531	Total
Lithics											
Scrapers	198 (3.9)	222 (3.6)	315 (6.2)	104 (7.1)	235 (9.3)	27 (2.8)	18 (3.9)	22 (7.3)	2 (8.4)	4 (10.8)	
Other	2,889 (56.9)	4,552 (73.5)	2,545 (50.4)	524 (35.6)	981 (38.7)	417 (43.8)	316 (69.1)	141 (49.8)	6 (25.0)	18 (48.6)	
Total	5,081 (23.9)	6,190 (28.0)	5,049 (22.8)	1,470 (6.6)	2,532 (11.4)	983 (4.4)	457 (2.1)	301 (1.4)	24 (0.1)	37	22,124
Utilized flakes	5,234 (24.0)	3,791 (17.4)	5,557 (25.4)	2,261 (10.3)	2,474 (11.3)	1,881 (8.6)	253 (11.6)	242 (1.1)	31 (0.1)	119 (0.5)	21,843 (4.2)
Debitage	105,637 (24.1)	98,292 (22.4)	85,091 (19.4)	48,576 (11.1)	42,251 (9.6)	43,475 (9.9)	3,286 (0.7)	9,030 (2.1)	510 (0.1)	3,086 (0.7)	439,234
Ground stone	1,735 (33.3)	2,044 (39.2)	580 (11.1)	71 (1.4)	558 (10.7)	195 (3.7)	18 (0.3)	12 (0.2)	0	2 (0.1)	5,215
Total Ceramics and Worked Lithics	133,976 (35.2)	115,537 (29.3)	102,272 (19.3)	58,375 (11.0)	51,489 (9.7)	49,575 (9.4)	5,744 (1.1)	9,626 (1.8)	643 (0.1)	3,550 (0.7)	531,787
Introduced rock	741.7 (30.1)	115.2 (4.7)	145.6 (5.9)	126.0 (5.1)	186.2 (7.6)	948.7 (38.5)	34.6 (1.4)	21.6 (0.9)	2.4 (0.1)	139.5 (5.7)	2,466.5 kg
Fauna	4,953	4,245	0	8	6	0	28	0	0	0	9.2 kg
Features											
Stain	0	1	0	0	0	2	0	0	0	1	4 (1.1)
Chipped stone cluster	8	1	0	1	0	0	0	0	0	0	10 (2.8)
Ochre concentration	0	0	0	0	0	0	0	0	0	1	1 (0.3)
Rock cluster	9	0	7	0	0	0	1	0	0	0	17 (4.7)
Fired hearth	30	15	2	0	0	0	1	0	0	0	48 (13.4)
Prepared area	2	8	5	0	0	0	0	0	0	0	15 (4.2)
Postmolds	0	0	0	0	14	0	5	0	0	1	20 (5.6)

TABLE 145

Summary totals of all counted and weighed materials and tested only features by site (continued).

Materials	22It576	22It539	22It590	22It621	22It623/624	22It563	22It606	22It622	22Mo675	22Mo531	Total
Features											
Pits	43	61	51	3	35	2	22	2	0	2	221 (61.6)
Bone cluster	0	0	1	0	1	0	0	0	0	0	2 (0.6)
Botanical cluster	0	4	0	0	0	0	0	0	0	0	4 (1.1)
Complex cluster	0	2	1	0	3	0	0	0	0	0	6 (1.7)
Total Features	93 (25.9)	94 (26.2)	67 (18.7)	4 (1.1)	53 (14.8)	12 (3.3)	29 (8.1)	2 (0.6)	0	5 (0.6)	359
Burials	11	17	1	0	0	0	0	0	0	2	32
Cremations	3	1	0	0	0	0	0	0	0	0	4

The chipped stone assemblages recovered from the major excavated sites also exhibited similarities and differences. The Walnut site (22It539) had almost 1,100 more specimens than the others, while the Poplar and Ilex sites produced almost equal numbers. These latter sites had similar proportions of projectile point/knives (23% and 21%), and Walnut had twice as many broken and unidentifiable fragments of chipped stone tools as the other two sites. Walnut also had more cores, preforms, and debitage than the other sites.

The number of ground stone tools varied widely between these three sites. Ilex had much less that the others (up to 72% less), and Walnut had the greatest number.

The number of features is almost equal at the Walnut and Poplar sites, whereas the Ilex site has 29% less than the others. The proportion of feature types was similar, however, with pits being the most frequent feature type (Table 147). No rock clusters were present at the Walnut site (22It539), while the Ilex site (22It590) had few hearths and fired aggregates. There were only two prepared areas at the Poplar site (22It576), five at Ilex, and eight at Walnut.

TABLE 147
Distribution of features with unknown cultural affiliation.

		Middle Archaic					Woodland			
Site	FA	E/MM	SWS-B	MA	LA	GF	Middle	Late	MS	Total
22It576	5 csc	1 p	1 blc	1 rc		1 fa		1cc		
	8 p	2 bu	26 fa							
			2 pa							
			32 p							
			8 bu							
			2 cre							
Subtotal	(13)	(1)	(61)	(1)	(0)	(1)		(1)		78 F
		2 bu	8 bu							10 bu
			2 cre							2 cre
22It539	0	1 fa	1 csc	3 bc		1 p	1 cc	3 p	1 cc	
		4 pa	1 blc	22 p					1 p	
		1 cre	1 exc	17 bu						
			12 fa	2 cre						
			4 pa							
Subtotal	(0)	(5)	(19)	(25)	(0)	(1)	(1)	(3)	(2)	56 F
				17 bu						17 bu
		1 cre		2 cre						3 cre
22It590	2 p	0	2 pa	2 p	2 p	1 rc	1 rc			
			3 rc			1 cxc				
Subtotal	(2)		(5)	(2)	(2)	(2)	(1)			14 F
22It621	1 p			3 p						4 F
22It623/ 22It624	1 p			1 p	4 p	2 p		3 p		
					1 cxc					
Subtotal	(1)			(1)	(5)	(2)		(3)		12 F

TABLE 147

Distribution of features with unknown cultural affiliation (continued).

		Middle Archaic					Woodland			
Site	FA	E/MM	SWS-B	MA	LA	GF	Middle	Late	MS	Total
22It563						7 cc 2 st				
Subtotal						(9)				9 F
22It606				1 p		1 p		12 p 1 h		
Subtotal				(1)		(1)		(13)		15 F
22Mo531							1 st			1 F
Feature Totals	5 csc 12 p	1 p 1 fa 4 pa 2 bu 1 cre	5 blc 38 fa 8 pa 1 csc 1 bc 1 cxc 3 rc	1 rc 3 bc 29 p	6 p 1 cxc	1 fa 1 p 1 rc 1 cxc 7 cc 2 st	1 cc 1 rc 1 st	1 cc 18 p 1 h	1 cc 1 p	
Subtotal	17 F	6 F 2 bu 1 cre	85 F 8 bu 2 cre	33 F 17 bu 2 cre	7 F	16 F	3 F	20 F	2 F	189 F 27 bu 5 cre

F=feature p=pit fa=fired aggregate
bu=burial cre=cremation rc=rock cluster
st=stain cc=ceramic cluster csc=chipped stone cluster
blc=blade cache cxc=complex cluster b=botanical cluster

EA=Early Archaic E/MM=Eva/Morrow Mountain SWS-B=Sykes-White Springs/Benton
MA=Middle Archaic LA=Late Archaic GF=Gulf Formational MS=Mississippian

At the four less intensively excavated sites, a single component was the objective of the investigations. In contrast to the three intensively excavated sites that shared few general traits. They differed in physiographic position, intensity of occupation, midden composition, and feature visibility. The Hickory site (22It621) was a multicomponent midden mound with a thick Middle Archaic to Woodland organic midden located in the floodplain. The Aralia site (22It563) was on the sloping surface of the valley wall adjacent to the floodplain and within 400 m (1,300 ft) of the Hickory site. It had only one major occupation, i.e. the Henson Springs horizon. The Beech and Oak sites were in the floodplain near the valley wall and contained multiple components throughout the prehistoric period. Middle and Late Archaic features, visible in the less organically stained midden, dominated. Site 22It606 was high on a terrace outlier overlooking the floodplain. While it contained multiple components, the occupation was the Late Woodland/Mississippian.

Except for 22It606 material recovered from the other three sites was about equal. This disparity between 22It606 and the other three sites probably reflects the lack of an excavated midden at the former.

The highest number of ceramics was recovered from the Hickory site. The Beech/Oak and Aralia had similar amounts, and Site 22It606 had approximately half the amount of these assemblages. Major components in the assemblages vary. 22It606 and Aralia produced large amounts of Late Woodland/Mississippian and Henson Springs ceramics, respectively. The multi-component Hickory site contained almost no Late Woodland/Mississippian ceramics, while the Beech/Oak ceramic assemblages contained 13.8% from that period. These two latter sites contained similar high amounts of Gulf Formational and Middle Woodland ceramics.

The chipped stone assemblages varied widely, and the Beech/Oak site contained far more than any other of the sites. Site 22It606 again had the smallest number. All sites had over 30% of their chipped stone assemblages composed of projectile points/knives, a figure higher than at the larger sites. The debitage at the Beech/Oak, Hickory, and Aralia was similar. Although the Beech/Oak site produced 30 times more ground stone tools than Site 22It606, there was a wide range between the other three sites.

The highest number of features was recorded at the Beech/Oak site (53). Site 22It606 produced 29 and the Aralia 12. Only four features were encountered at the Hickory site. Pits were the most frequent type of features at all sites. Postmolds were present at the Beech/Oak and 22It606 sites, however, no patterns were detected. There were no prepared areas at these sites, and few hearths were identified. One ceremonial cache of purposefully broken blades and bifaces was present in the Late Archaic component at the Beech/Oak site.

The three sites which were tested varied widely in location and type. The Mud Creek site (22It622) was a low mound in the floodplain of the Tombigbee, near Site 22It606. The Smilax site was located in a plowed field 64 km (40 mi) south of the Mud Creek site on a low terrace edge near Amory. The Dogwood Mound, also near Amory, Ms, was a Middle Woodland burial mound on the edge of the floodplain.

The amount of material recovered from these sites varied widely, with the Mud Creek site producing almost nine times that of the Smilax site. None of the sites produced many ceramics. The Dogwood Mound had the highest number, with only 306 specimens. The most frequent artifact type was debitage. The Mud Creek site had over 9,000 specimens, and, surprisingly, the burial mound had over 3,000. Features at these sites were scarce, with only a total of 11 encountered. The Smilax site produced no cultural features.

The materials and features recovered in this project provide a good sample of the archaeological record of the Archaic stage occupations of the Upper Tombigbee Valley and a few <u>in situ</u> samples of some of the post-Archaic occupations. Of all the deposits investigated, there were 11 intact midden deposits (18.3% of the components encountered) and 189 features (62.6% of those recovered) that could be affiliated with a cultural component (Table 148). A brief summary of the distribution and contents of the archaeological material by component follows.

The sample of the Archaic stage included 10 intact middens and 148 features. Early Archaic diagnostic projectile point/knives were recovered from seven of the 11 sites investigated (Table 149) and included five chipped stone clusters and 12 pit features (Table 147). The highest number of diagnostic projectile point/knives were recovered from the Poplar (22It576) and Ilex (22It590) sites. The Poplar site produced 46 diagnostic projectile point/knives and 13 features associated with the Early Archaic period. The Ilex site (22It590) deposit contained more diagnostics (65) but fewer features (only two). The Hickory site (22It621) had intact midden but no features, and the Walnut site (22It539) had a low density midden and no features. The

TABLE 148
Integrity of middens and cultural affiliation of features of the 11 sites investigated.

Late Paleo-Indian	Archaic			Gulf Formational	Woodland		Mississippian
	Early	Middle	Late		Middle	Late	
22It539							
MM	IM	IM F(65)	MM	MM F(1)	MM	MM F(2)	MM F(2)
22It576							
MM	IM F(7)	MM F(79)	MM	MM F(3)	MM	MM	MM F(2)
22It590							
MM	IM F(2)	IM F(9)	MM	MM F(2)	MM F(1)	MM	MM
22It563							
A	A	A	A	Early:MM Late:IM F(9)	MM	MM	A
22It621							
MM	IM F(1)	IM	MM	MM	MM	MM	A
22It623/22It624							
A	IM	IM F(3)	IM F(5)	MM F(2)	MM	MM F(1)	MM
22It606							
A	MM F(3)	MM	MM	MM	MM	MM F(9)	MM
22It621							
A	MM	MM	MM	MM	MM	MM	MM
22Mo531							
A	A	A	A	MM	MM	MM	A
22Mo675							
A	A	A	A	MM	MM	MM	A
Total Components							
3	7	7	7	10	10	10	6
Intact Middens							
0	5	4	1	1	0	0	0
Features							
0	17	125 F 27 BU 4 CRE	7	16	3	20	2

A=Absent IM=Intact Midden MM=Mixed Midden BU=Burial CRE=Cremation F=Features sample of the Early Archaic from the Beech/Oak site (22It623/22It624) was so small that it cannot be evaluated. An intact midden was identified, however. These assemblages and features reflect low density occupations which were oriented to hunting and tool preparation and repair.

The Middle Archaic period produced the most diverse and rich archaeological record. It was identified at six of the sites investigated and the sample includes four intact middens and 124 features. The Walnut site appears to have been a major focal point of the Middle Archaic in the Upper Tombigbee Valley and contained a thick intact midden with 359 diagnostic projectile point/knives (Table 149), 44 features, 17 burials, and one cremation. The Poplar site was also a major focal point for this period and contained 63 features, 10 burials, and two cremations. This site did not contain an intact midden but did produce 109 diagnostic projectile point/knives. The Ilex site contained 120 diagnostics but only seven features which could be associated with this component. The other three sites containing Middle Archaic components were much weaker than those just described, and each contained less that 51 diagnostic projectile point/knives and a total of five features.

The range of features from the Middle Archaic components is greater than for any other prehistoric component encountered in this project, i.e.,

62	pits
39	fired aggregates (prepared hearths)
12	prepared areas
4	rock clusters
3	botanical clusters
2	blade caches (quarry blanks)
1	chipped stone cluster
1	complex cluster
17	burials
3	cremations

This information alone reflects the change and concentration of activities in the Upper Tombigbee Valley from the previous Early Archaic period. This project sampled more intact middens from this former period (five) but recovered only 17 features (seven times less) and almost four times less diagnostic projectile point/knives. The swiftness and degree of adaptive change in the Middle Archaic period is the most dramatic recorded in the prehistoric period.

The distribution of the features during the Middle Archaic period at the sites investigated is far from even. As previously described, the Walnut and Poplar sites contained 107 (86.2%) of all the features, as well as all the burials and cremations. These sites obviously were focal points of this period upstream from Fulton, Ms in the Upper Tombigbee Valley. The four other sites which were occupied during this period were smaller and probably were used as satellite camps for resource procurement.

Twenty-five acceptable dates were obtained from the Middle Archaic period (Table 150). These dates suggest the following ranges for the recognizable divisions of the Middle Archaic period:

7,500 - 6,300 B.P.	Eva/Morrow Mountain horizon
6,300 - 6,000 B.P.	Sykes-White Springs/Benton horizon
6,000 - 5,000 B.P.	Benton horizon

TABLE 148

Distribution by site of Archaic projectile point/knives.

Type	Site										Total
	22It576	22It539	22It590	22It621	22It623/624	22It563	22It606	22It622	22Mo675	22Mo531	
Early											
Cumberland			1	1							2
Dalton	2	2	5								9
Beaver Lake			1								1
Quad				1							1
Greenbriar	2		21	2	1			2			28
Kirk	40	14	31	14	3		7	4			113
Big Sandy	2	8	6	1	2		1				20
Subtotal	46	24	65	19	6	0	8	6	0	0	174
Middle											
Cypress Creek	2	11	11	2							26
Eva	44	4	11	6	1						66
Morrow Mountain	17	27	9	12	12						77
Sykes-White Springs	30	84	20	3	5		1				143
Vaughn	4	4	2	1	2						13
Benton	12	229	58	8	25						332
Beachum			9	1	6						16
Subtotal	109	359	120	33	51		1				673
Late											
Gary	3	3	9	2	2	2			1		22
Ledbetter Pickwick	13	7	16	7	9			3			55
Little Bear Creek	368	3	86	59	53	36	1	10	2	1	619
McIntire	15		11	2	24		1				53
Savannah River	3	1									4
Flint Creek		9		22	21	98	1	1	1		153
Mud Creek	1	3			2	1					7
Wade				1	6	1		1			9
Subtotal	403	26	122	93	117	138	3	15	4	1	922
Total	558	409	307	145	174	138	12	21	4	1	1,769

TABLE 149
Acceptable radiocarbon and archaeomagnetic dates recovered from all sites investigated.

Component	22It576	22It539	22It590	22It623/624	22It563	22It606	
Late Woodland/ Mississippian						412±50 600±80 680±80 730±55 580±60 860±60	
Gulf Formational					2,379±50		
Late Archaic				3,850±65 4,160±65			
Benton	5,552±70 5,850±50-70	5,335±75(A) 5,490±75(A) 5,490±70 5,552±155 6,050±50(A) 6,000±50(A)	5,227±70 5,758±75	5,290±75 5,310±70			
Middle Archaic			5,778±75				
Sykes-White Springs/Benton	5,840±120 5,995±155	5,950±50 5,902±115 6,150±50(A) 6,149±96 6,250±50(A) 6,200±50(A) 6,300±50(A)	6,293±75			5,800±160	
Eva/ Morrow Mountain	7,426±650	6,242±70 7,303±95 7,468±85					
Total number of samples submitted for dating	7 C^{14} 2 archmag	11 C^{14} 16 archmag	13 C^{14}	7 C^{14}	1 C^{14}	6 C^{14}	45 C^{14} 18 archmag

The apparent "gap" between the Early Archaic Kirk horizon, which has been dated elsewhere at 9,500-9,000 B.P., and the Eva/Morrow Mountain horizon of the Middle Archaic, dated consistently in this project as beginning ca. 7,500 B.P., was one of the most intriguing aspects of this period dating. A rationale for this apparent gap has not been fully developed.

The sample of the Late Archaic period deposits was disappointing. While the recovered diagnostic projectile point/knives from this period were recorded from all sites investigated and were more abundant those from all preceding periods (922), only one intact midden and seven associated features were recovered. The midden and five of the features were from the Beech/Oak site (22It623/22It624) and were composed of pits and one complex cluster. The large number of diagnostics reflects continued use of the area, however the deposits were disturbed through post-occupation pit digging and vandalism. The Poplar site clearly contained the most projectile point/knives (43.7%), followed by the Beech/Oak (15.0%), and Aralia (12.7%) sites (Table 149). The increasing number of sites containing these diagnostics suggest either a settlement pattern and site use change and/or an increase in population.

Several factors obscure interpretations of the Late Archaic assemblages. First, the "diagnostics" are not as clearly associated with this period as the preceding ones. There are indications that the Little Bear Creek type is associated both with the Late Archaic and the following Middle Gulf Formational. Perhaps the increased number of these point types reflects more than the Late Archaic occupation. Also, the lithic experiments performed in this study indicate that the Little Bear Creek point types are more durable than those from preceding periods. Hence, the archaeological record could contain a disproportionate number of identifiable specimens which would bias the comparisons and interpretation based upon them.

Two dates, which place it between 4,200-3,900 B.P., were obtained on Late Archaic features from the Beech/Oak site. The dates are suspect because the material dated was obtained from a large pit complex, which was also used by the preceding Benton occupants. On the other hand, a Little Bear Creek projectile point/knife type found with the dated materials tend to confirm them.

The post-Archaic deposits are best identified by the presence of ceramics. Ceramics were found at all 11 sites investigated and were an abundant artifact type (42,371 total specimens). As with the late Archaic deposits, all but a few (two) middens were disturbed. While the relationship between number of ceramic specimens and nature of an occupation is not known, it must be used as the primary measure of the post-Archaic occupations of the sites investigated in this project, since it is the only diagnostic artifact type recovered.

The Gulf Formational stage is best identified by the presence of fiber-tempered ceramics and the diagnostic Alexander ceramic series. Fiber-tempered ceramics (Table 146) were recovered at nine of the 11 sites investigated. The Aralia (22It563) and Smilax (22Mo675) sites were almost totally lacking in fiber-tempered ceramics. The remaining sites contained from 12.1-20.4% fiber-tempered ceramics in the recovered assemblages. The Ilex site had the highest percentage, and the Poplar site had the greatest number of specimens recovered. The Alexander series was present at all six of these latter sites, and it was the dominant type at the Aralia site.

There were 16 features associated with the Gulf Formational stage (Table 147). These and included pits, fired aggregates, rock clusters, complex clusters, ceramic clusters, and midden stains. Most (9) were at the Aralia site and are associated with the late Gulf Formational, Henson Springs horizon. One radiocarbon date of 429 B.C. was obtained from this component, placing it in the early portion of period documented for the Henson Springs horizon. The ceramic analysis and seriation confirm this temporal placement.

The Middle Woodland period is hard to document even with the large numbers of ceramics, because sand tempering was used in both the late Gulf Formational and the Middle Woodland periods. However, limestone tempering was also practiced during this period and was limited to it. Sand- and limestone-tempered ceramics were recovered from all sites investigated. Sand tempering composed more than half of the complete assemblages from all but two sites (22It606 and 22It539). In the other assemblages, it composed from 53.0-97.9% of the total ceramics and was highest in proportion at the Aralia site. The Poplar site (22It576) contained the highest number (8,638) of these specimens. Only three features could be affiliated with this period: one ceramic cluster, one rock cluster, and one stain of ocher in the burial mound (22Mo531). The presence of the burial mound confirms the participation in this ceremonial activity and ties the residents of the Upper Tombigbee Valley in with the other known area mound groups, such as Pharr and Boyd.

Late Woodland period ceramics are somewhat easier to segregate, because of the close association of grog and bone tempering. Grog tempering appeared previously, but the percentages were low. In this study, grog tempering is used as a key indicator of the Late Woodland. Bone tempering appears to have been produced primarily in the Late Woodland period. Grog-tempered ceramics were recovered from all sites investigated, and bone-tempered were recovered from five. The highest number and largest percentage of these temper types were recovered from Site 22It606. Bone tempering and grog tempering were also high in percentages at both the Walnut (27.6%) and Poplar (14.1%) sites, which suggests the importance of these localities during this period.

Twenty features were recovered from this period, i.e., 18 pits, one ceramic cluster, and one hearth. Most (13) of these were from 22It606. Six radiocarbon dates were obtained from the Late Woodland component at 22It606 (Table 150). These dates range from A.D. 1,090 to A.D. 1,538 and lead to the inference that the Late Woodland period in the Upper Tombigbee Valley coincides with the same time frame as the Mississippian period in other areas.

The Mississippian period is not easily recognized in the Upper Tombigbee Valley, especially in the central valley. The only indication of it is shell-tempered pottery, and shell tempering is not a sure marker of the Mississippian period. It is, however, the only measure available in the information recovered in this project and will be used.

Shell-tempered ceramics were recovered from the seven sites which were extensively or moderately excavated. None of the tested sites produced any shell-tempered specimens. The distribution of shell tempering follows that of grog and bone. The highest proportion is 11.7% from 22It606, with similar percentages from the Walnut and Poplar sites (8.8% and 8.0%, respectively). The amounts recovered from other sites are small (less than 2.0%). The small percentages and same distribution pattern as the grog- and bone-tempered ceramics suggest that shell tempering is most likely associated with the Late Woodland ceramic assemblage, rather than with the Mississippian stage occupation.

REVIEW OF HYPOTHESES AND RESULTS

SPATIAL ANALYSIS OF THE MIDDLE ARCHAIC PREPARED AREA

With the wealth of archaeological information recovered and the natural limits to the amount of analysis that can be performed in any single project, it was not possible to perform complex spatial analyses during this study. However, it has been possible to perform one test case to demonstrate the utility and limits to two different methods of spatial analysis in addressing a specific research question.

One of the most interesting phenomenon that was encountered in this study was the large complex "prepared area" features associated with the Middle Archaic occupation of the midden mounds. These were present at the Walnut (22It539), the Poplar (22It576) and the Ilex (22It590) sites. They may also have been present at the Hickory site (22It621) but the deposits were disturbed by amateur digging and therefore could not be detected. These features were characterized by an area of yellowish orange silt loam which contrasted with the surrounding dark brown organic midden matrix. The silt loam matrix of the features contained many pockets of charcoal and fragments of hard-fired silt loam. Artifacts were generally scarce within the feature matrix. Included in the prepared areas were well-defined hard-fired aggregates which very likely were hearths. These averaged 50-100 cm (19.7-39.4 in) in diameter, were usually oval to circular and often had two or more "layers" of fired silt loam which was very hard and reddish orange in color. The fired aggregates also occurred regularly outside of the prepared areas in the general midden in the Middle Archaic middens.

The composition of the prepared areas varied between the sites at which they occurred. This is likely due to both variation between the users of the features, as well as the different depositional and preservational environments. For example, those at the Walnut site were well defined and had multiple hearths, while those at the Poplar site were not well defined and had few hearths. However, one at the Poplar site had a center clay-lined post hole, and both had an associated flexed burial. The prepared areas at the Ilex site were even less well defined and were not mappable. The existence of prepared areas at this site was inferred from the proximity of hearths and burned sandstone concentrations.

Other researchers have also encountered different varieties of the prepared areas at other midden mounds: Brinkley (Otinger et al. 1982), Mann (Dye and Watrin 1985), East Aberdeen (Rafferty et al. 1980) and 22Mo752 (Bense 1982b). The characteristics and preservation of these phenomena vary in detail, but all appear to be generally similar. The interpretation of the function of these features includes structures, areas of residential activity and high intensity activity areas. One of the problems in interpreting these features is documentation of associated artifacts. These features are contained in a midden which has a high volume of artifacts, charcoal and other features and there is no delineating attribute that identifies peripheral areas associated with the fired clay areas. Therefore, it is not known how much, if any, of the surrounding artifacts are included within the prepared area and how much to eliminate. Therefore, the questions of function and activities associated with these prepared areas has been a problem for the past seven years.

Due to the importance of this issue, spatial analysis will be used in this example study to attempt to identify patterns in the midden material surrounding a prepared area that could be associated with it. The feature and block selected for study is Feature 120 at the Walnut site as this was the best defined, most carefully excavated, had more piece plotting and was the best dated. Background information on this feature will be briefly reviewed here.

The Walnut site was the largest midden mound encountered in the upper valley; it was ca. 9,000 square meters in size and was 1.5 m (5 ft) above the floodplain. The Walnut site had good cultural stratification due to thickness of the sedimentary deposits. Its physiographic position in the floodplain was at the confluence of two major tributaries which form the Upper Tombigbee River (Mackey's and Little Brown Creeks) both of which have a coarse bedload which contributed to the large size of this parallel bar and vertical separation of the cultural material within the sediments.

In this site, the Middle Archaic component occupied a thick and relatively discrete zone between Levels 5 and 13 (Ensor and Studer 1982: 5.77-5.78). Associated with this component was a linear arrangement of burials in a "cemetery". The individuals were extended and often had more that one individual in the burial pit. This is unique in all midden mounds, and probably reflects the importance of this site above the others. Burials have been encountered in several of the 16 other midden mounds, but not organized in this manner nor in the extended position. Based on this and other information from the Walnut site, it appears that this was some sort of a focal point during the Sykes-White Springs/Benton horizon and due to its physiographic position, this component was well sealed.

There were two prepared areas associated with the Middle Archaic component at this site. Feature 120 which was located in the highest portion of the site and the other (Feature 6) was on the southeast edge of the high site surface area. Other fired aggregates or hearths were encountered throughout the site and are associated with this occupation.

Feature 120 was identified prior to excavation by systematic coring of the site. The excavation unit (Block C) was centered over it and the documentation of this feature was the primary purpose of this excavation unit. Block C was a 10x10 m (33x33 ft) block excavated in 10 cm (3.9 in) levels by 2x2 m (6.6x6.6 ft) units. The top of the feature was buried 80-90 cm (31.5-35.5 in) below the surface and was first encountered in Level 9. The feature was isolated and pedestaled leaving any yellow or red stains or patches of fired clay which were connected to or part of the feature. At the bottom of Level 12, the feature limits had stabilized and the feature was cleaned and excavated.

A total of 26 different strata were identified in the feature, most varying in color (red or yellow) and compactness. Several charcoal concentrations were also contained in the feature. The feature was discontinuous and was riddled with rodent burrows, root stains and pockets of midden, all of which were which were identified and removed. Once the feature was fully exposed, it was 20-30 cm (7.9-11.8 in) thick and dome-shaped in profile and amorphous in outline covering a 6x6 m (19.8x19.8 ft) area (Figure 7). There were two fired areas, both composed of 1-4 cm (3.9-1.6 in) thick layers of fired silt loam: a larger one (120x75 cm/47.3-29.5 in) in the center and a smaller one in the northeast corner.

The four archaeomagnetic dates and one radiocarbon date indicate that it was in use between 6,250 and 6,050±35 years ago. The north hearth dated 6,250±35 for the lower layer of fired clay and 6,200±35 for the upper layer. The center hearth archaeomagnetic dates were 6,050±35 for the lower layer of fired clay and 6,150±35 for the upper layer of fired clay. The charcoal area in the northeast corner of the feature dated at 6,149±95 (DIC-1952). From these dates, it appears that the hearths in the prepared area were used serially, not at the same time. The northeast fired area was used first, with a 50 year difference between last firings. The center hearth area was then used with 100 years between last firings. The central hearth area was much larger and thicker, perhaps accounting for the longer use period. The charcoal apparently was from the central hearth cleanings, although it was adjacent to the northeast hearth.

The artifactual material contained in the feature consisted of 214 artifacts and 69 kg of weighed material. The artifacts consisted primarily of flakes and broken chipped stone tools and included eight projectile point/knives (one complete Benton and one Big Sandy fragment). The weighed material was dominated by fired clay (67.6 kg) with sandstone being the most frequent introduced rock type. The cultural material was concentrated in the center part of the the feature around the center hearth area with only minor amounts present in the outer area. The true association of these artifacts with this feature cannot be ironclad.

The midden surrounding and covering the feature was rich in cultural material and the separation of feature vs. midden was not clear-cut except for the hard fired areas. There were no postholes or pits defining an enclosing structure, nor any other patterning of stains or features. It is possible that the size of the excavation units were not large enough to include perimeter features such as postholes, however, the 10x10 m (33x33 ft) size of the unit surrounding Feature 120 is larger than any previously reported structure for this time period.

In an attempt to understand the context of the prepared area with their serially used hearths, artifact patterning in the surrounding midden was recorded in the field through piece plotting and the use of 10 cm (3.9 in) levels for general midden excavation. In the preliminary report, Ensor and Studer (1982:87) note that while artifacts were relatively scarce in the prepared area, they noted that artifacts appeared to be concentrated around the western perimeter the majority of which were chipped stone fragments and projectile point/knives.

The main issue involved in this issue is determining which artifacts in the midden matrix around the feature are associated with the feature and which are not. Proximity to the feature is probably important, but how close and where is the line drawn both horizontally and vertically? The piece plotting done by the excavators concentrated on chipped stone tools, but abundance of artifacts in the midden caused problems in isolating all of these artifact types. For example, there were 54 projectile point/knives (both whole and fragments) piece plotted in the 30 cm (11.8 in) of midden in the block surrounding the feature. However, this is only 20% of the total projectile point/knives from the this 30 cm (11.8 in) of midden excavated in this block. With 80% of the projectile point/knives unplotted, the patterning seen in the plotted specimens probably is not valid.

Due to these problems of lack of a clear-cut periphery and hand-plotting specimens in a high density midden, a spatial analysis of all the material (plotted and unplotted) from the midden surrounding the feature was conducted.

A file was made of all the non-feature material from the level in which the top of Feature 120 first appeared (Level 9) through its base (Level 13) in Block C (10x10 m/33x33 ft). This was then organized into the smallest excavation proveniences (2 m x 2 m x 10 cm/6.6 ft x 6.6 ft x 3.9 in units) for analysis. Then frequencies of artifact groups were then calculated for each of the units. These groups were projectile point/knives, other chipped stone tools, cores/preforms, "Combination" (projectile point/knives, other chipped stone tools, cores/preforms), debitage, and ground stone. In addition, the total amounts of counted specimens (stone tools and debitage) and the total amount of weighed materials (introduced rock and fired clay) were calculated for each level.

This data was then analyzed using both SAS and SYMAP program packages. The objective of this study was to present this data in such a manner that if patterns existed in the data they could be identified. The first method was using the SAS plot programs. This generated a simulation of the floor of the excavation unit divided into the 25 2x2 m (6.6x6.6 ft) units with a graduated symbol in the center of each depicting the frequency of the designated data category. The choice of symbols that could be reproduced using only black and white were limited to "spikes" and "patterns". Studies of these plots did not reveal any identifiable patterns except for the absence of midden in the area of the feature. The spike plots were the easiest to read, but the large number and close proximity of the spikes made it difficult to interpret. As can be seen in the examples of these plots in Figure 54, the rows are difficult to identify and compare at each level. However, study of the spike printouts seemed to indicate that each level had a different distribution pattern and patterns between levels were not revealed.

In an effort pursue this issue, the data were analyzed through the SYMAP computer mapping program package. Two mapping programs were used: contour and trend surface analysis. The mapping area (or window) was the 10x10 m (33x33 ft) block and the same data (artifact categories by level) used in the SAS analysis was entered. Contour maps display data by interpolating a continuous surface in the regions where there are no data points, basing the values on the distance to and the values of neighboring data. The contour lines drawn identify areas of relatively higher and lower frequencies of specimens. Trend surface maps display data differently in that the direction of "trends" in the frequency of specimens is displayed over the whole unit. The biggest difference in the two mapping methods is that contour maps are more sensitive to frequencies within the block while trend surface maps display the interpolated "tendencies" or patterns of the frequencies.

In using these mapping programs, one important factor to be considered is that the feature was excluded from the data and the volumes of the 2x2 m (6.6x6.6 ft) units are unequal. As depth increased, less midden was excavated and more feature was left pedestaled. This effects the distribution maps in that the units containing the feature are considered in the mapping program as areas of low frequency rather than areas excluded due to the expansion of the feature. To partially compensate for this factor, the "footprint" of the feature has been marked on the maps so that it can be considered in the following interpretation.

To get a general pattern for the distribution of stone tools and debitage, the first pattern considered was the total amount of counted specimens in each level. The contour maps of this data are presented in Figure 55a and Figure 55b as well as the trend surface maps in Figure 56. In comparing the trend and contour maps for the same levels, the relationship between them is clear. The smoothing effect of the trend surface contrasts to the more patchy and detailed contour maps.

A preliminary study of the contour maps by level reveals that while there are patterns in the distribution of specimens, most do not hold through consecutive levels. For example, in Level 9, where only the top of the feature in the center of the block was exposed, the material was concentrated east, northeast, and west of the feature. However, in Level 10 material is concentrated southeast and west of the feature. In Level 11 material is concentrated north and west of the feature. In Level 12 material is

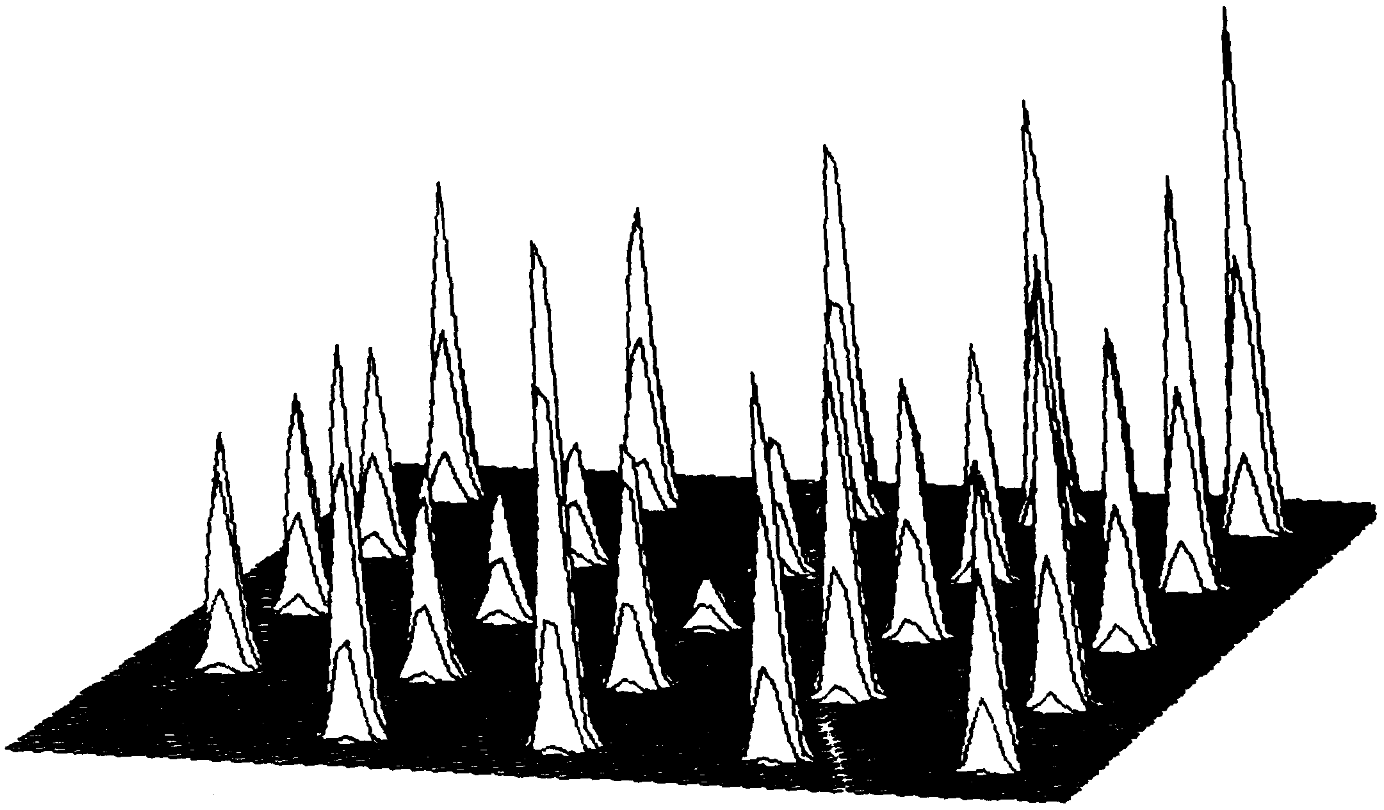
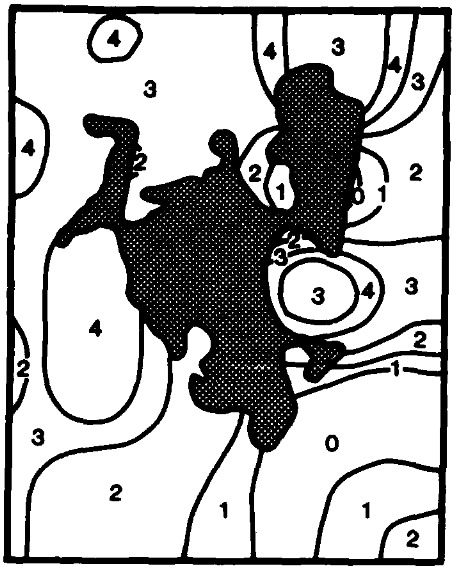
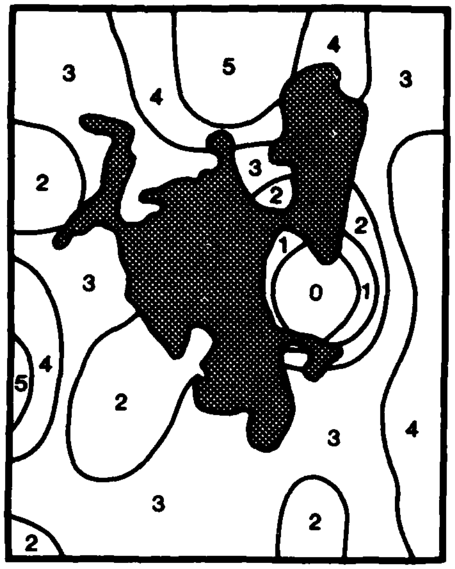


Figure 54 SAS "spike" plots of counted artifacts, Level 11, Block C, 22It539.



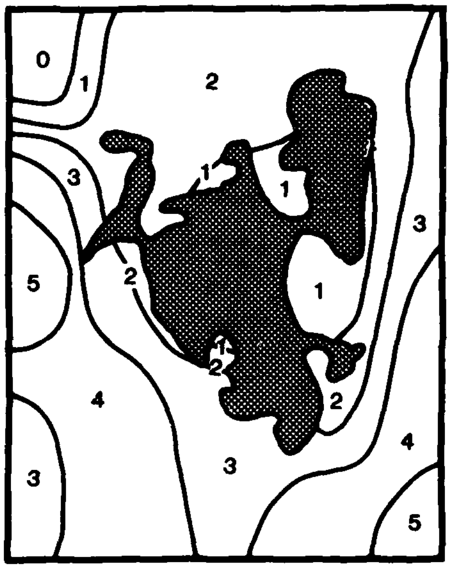
Level 9 Classes: in numbers

0 = 50 - 63
1 = 64 - 73
2 = 77 - 89
3 = 90 - 102
4 = 103 - 115
5 = 116 - 129



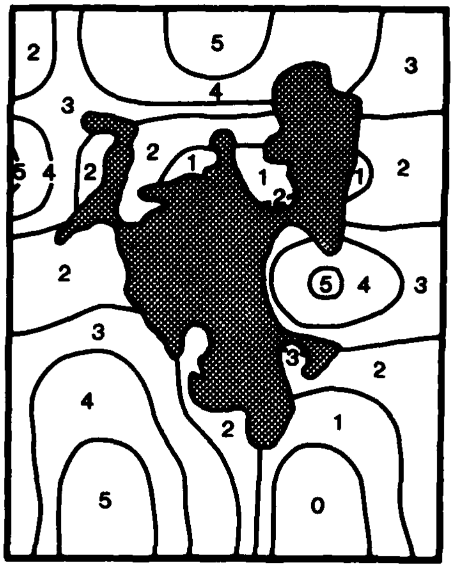
Level 10 Classes: in numbers

0 = 3 - 27
1 = 28 - 51
2 = 52 - 75
3 = 76 - 99
4 = 100 - 123
5 = 124 - 147



Level 11 Classes: in numbers

0 = 0 - 28
1 = 29 - 56
2 = 57 - 85
3 = 86 - 113
4 = 114 - 141
5 = 142 - 170



Level 12 Classes: in numbers

0 = 50 - 67
1 = 68 - 84
2 = 85 - 101
3 = 102 - 118
4 = 119 - 135
5 = 136 - 152

Figure 55a Contour maps of counted specimens in Levels 9 - 12, Block C, 22It539. (Feature 120 blocked out).

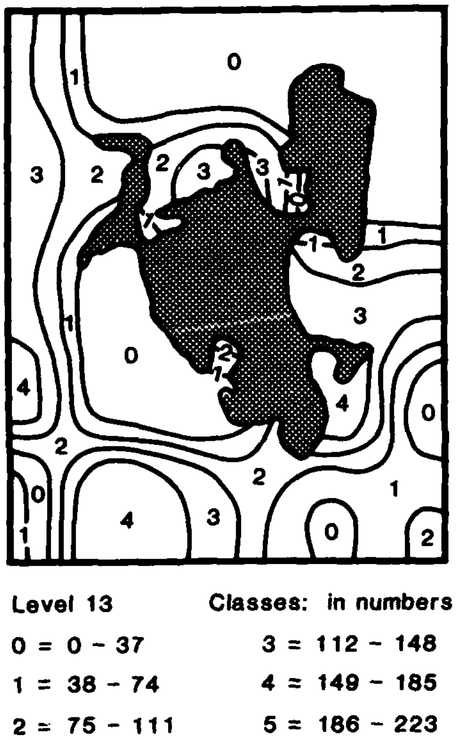


Figure 55b Contour map of counted specimens in Level 13, Block C, 22It539 (Feature 120 blocked out).

concentrated east and west of the feature. In Level 13 material is concentrated east, south and west of the feature. This analysis indicates that throughout the 200-year use of this feature and buildup of midden around it, consistently more materials were deposited on the western periphery that any other peripheral area. Knowing that the northeast hearth was used first and the central hearth used last does not aid in understanding the differing position of other areas of material concentration between levels.

The trend surface maps generally reflect the concentrations described above. However, the increased generalization or lack of specificity decreases the sensitivity to the changing patterns. The trend of more materials in the western part of the block is reflected in these maps, as well as the variations in the other levels.

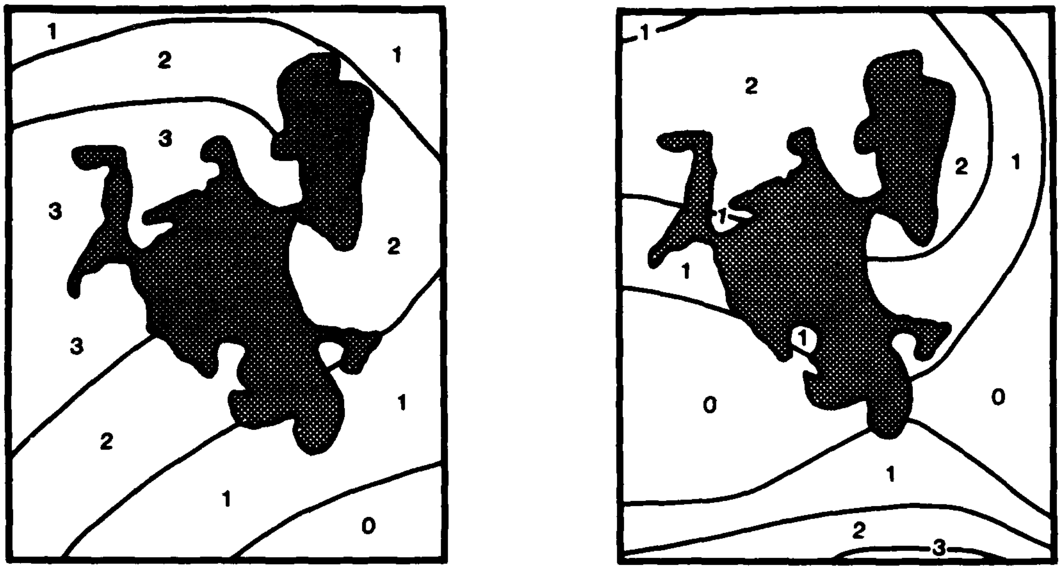
In an effort to identify patterns between levels and relate them to the specific artifact categories to the totals used in the first contour study, contour maps of one tool type, projectile point/knives, were selected. These are presented in Figure 57, and it can be seen that when compared to those for the totals, the patterns for each level are not similar. When viewed singly between levels, the concentration of projectile point/knives tends to be on the western and northern areas of the block.

Maps were made of the other artifact categories with the same general results: a general trend for more material to be located along the western perimeter with variance in the other areas of concentration between levels.

Overall, the use of SYMAP for spatial analysis to address the patterning of material within the confines of a 100 square meters (119.6 square yards) block with an approximately 36 square meters (43 square yards) feature in the center did reveal some patterning. First, the consistent presence of higher amounts of material in the midden on the western periphery was documented. Also, these maps documented the consistent changing of other areas of concentration throughout the buildup of midden. While this is a pattern in itself, it is difficult to interpret. The problem of the unexcavated feature areas being included in the interpolation of the data by the SYMAP programs is troublesome, and undermines the credibility of the patterns depicted in the contour and trend surface maps.

After using SYMAP to address this research question, it appears that the best use of this package would be at the site level of study not a single excavation unit. For example, the question of site activities during the Middle Archaic Sykes-White Springs as opposed to the Benton horizon at the Walnut site could be analyzed through contour and trend surface mapping by using all midden material from the designated levels from all excavation units. This larger area and sample size is more conducive to these mapping programs than the restricted area of one small excavation unit. These programs are designed to reveal general trends and patterns in large geographic areas and likely could produce spurious patterns when confined to a small unit with a large feature.

In spite of the problems with SYMAP, it was more useful, by far, than the SAS plotting. The latter method identified no patterns and the plots were difficult to study.

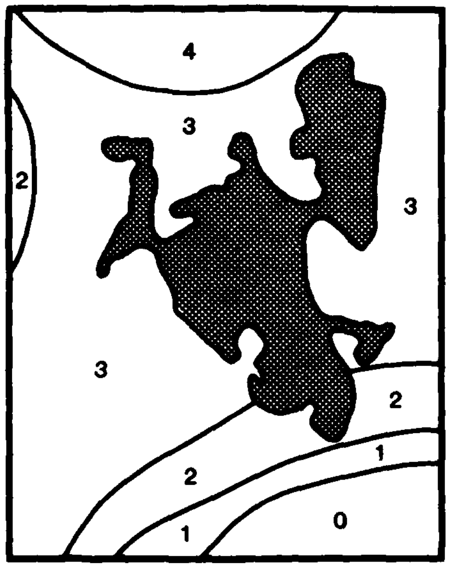


Level 9 Classes: in grams

0 = 33 - 57g
1 = 58 - 82g
2 = 83 - 106g
3 = 107 - 130g

Level 10 Classes: in grams

0 = 42 - 71g
1 = 72 - 99g
2 = 100 - 128g
3 = 129 - 156g



Level 12 Classes: in grams

0 = 62 - 89g
1 = 90 - 116g
2 = 117 - 144g
3 = 145 - 172g
4 = 173 - 199g
5 = 200 - 227g

Figure 56 Trend surface maps of all weighed material, Levels: 9, 10, and 12, Block C, 22It539 (feature 120 out).

PALEOENVIRONMENT

The environmental hypotheses addressed in these investigations focused on temperature/moisture fluctuations and periods of landscape stability/flux in the Early and Middle Holocene. Soil development was investigated.

It was hypothesized that the Early Holocene was cooler and moister than present; the floodplain was characterized by an unstable surface; and the Tombigbee was a braided stream. These hypotheses were supported primarily by sediment analyses which demonstrated a higher sedimentation rate in the Early Holocene (8-17.6 cm/century) than any other period. Particle size analysis documented that the Early Holocene sediments contained more coarse materials than deposits of later periods. The high sedimentation rate and the coarse particle size suggest that the floodplain landscape of the Early Holocene was unstable with more widespread lateral erosion and deposition in the floodplain than at any other period.

This hypothesis was also partially supported by palynological evidence from 22It590. In the Early Holocene (Early Archaic) deposits of 22It590, boreal type pollen was recovered in several samples, indicating a cool and moist climate. Samples selected from contemporaneous sediments from other sites investigated did not contain this type of pollen. Therefore, the boreal pollen most likely represented a relic community near that site, rather than predominate conditions. Scarcity and preservation biases of the macrobotanical remains precludes their use in testing other environmental hypotheses.

The second paleoenvironmental hypothesis tested was that the Middle Holocene was a period of maximum post-glacial warmth, probable dryness, and landscape stability. This hypothesis was supported by three lines of evidence: 1) the development of deep polygonal cracks in the Early Holocene deposits, 2) a decrease in the sedimentation rate, and 3) a decrease in sediment particle size. The soil of the Late Pleistocene/Early Holocene deposits developed deep cracks in the Mid-Holocene. These cracks are strong indicators of a xeric climate. The development of a paleosol in the Early Holocene deposits also indicates that the landscape had already stabilized prior to this xeric period. More humid conditions about 6,000 B.P. resulted in severe flooding and erosion of the upper portion of the paleosol down to the structural B horizon.

The third area of paleoenvironmental investigation was the development of anthropic epipedons in the sediments of the three sites investigated: 22It539, 22It576, and 22It590. These soils are distinctive features of the sites and serve as indicators of long-term habitation. The detailed chemical and physical analysis of these epipedons has produced baseline data for this unique product of human occupation. The well-drained, organically enriched soils of the midden mounds in the floodplain have been subjected to an extreme amount of bioturbation by trees and burrowing animals. This has modified soil genesis in these organically rich deposits. Extremely high amounts of phosphorus and the coating of grain surfaces with organic mineral bonding resulting from human habitation has retarded normal soil development processes. The black, greasy midden has remained an A horizon for 5,000 - 6,000 years.

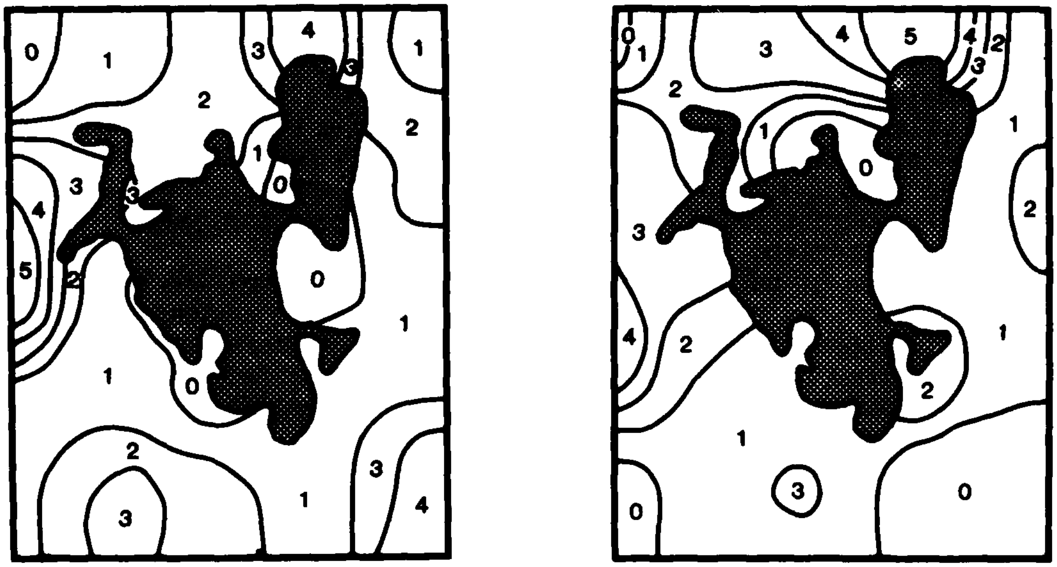
From the studies performed on site formation and soil development processes, the following sequence of events on floodplain midden mound sites such as 22It539, 22It576, 22It590, 22IT621, 22It623 and 22It624 is supported and graphically represented in Table 151 and Figure 58:

Level 9 Classes: in numbers

1 = 1
2 = 2
3 = 3
4 = 4
5 = 5
6 = 6
7 = 7

Level 10 Classes: in numbers

0 = 0 - 1
1 = 2 - 3
2 = 4 - 5
3 = 6
4 = 7 - 8
5 = 9 - 10



Level 11 Classes: in numbers

0
1
2
3
4
5

Level 12 Classes: in numbers

0 = 0 - 1
1 = 2 - 3
2 = 4 - 5
3 = 6 - 7
4 = 8 - 9
5 = 10

Figure 57 Contour map of projectile point/knives, Levels 9 - 12, Block C, 22It539. (feature 120 blocked out)

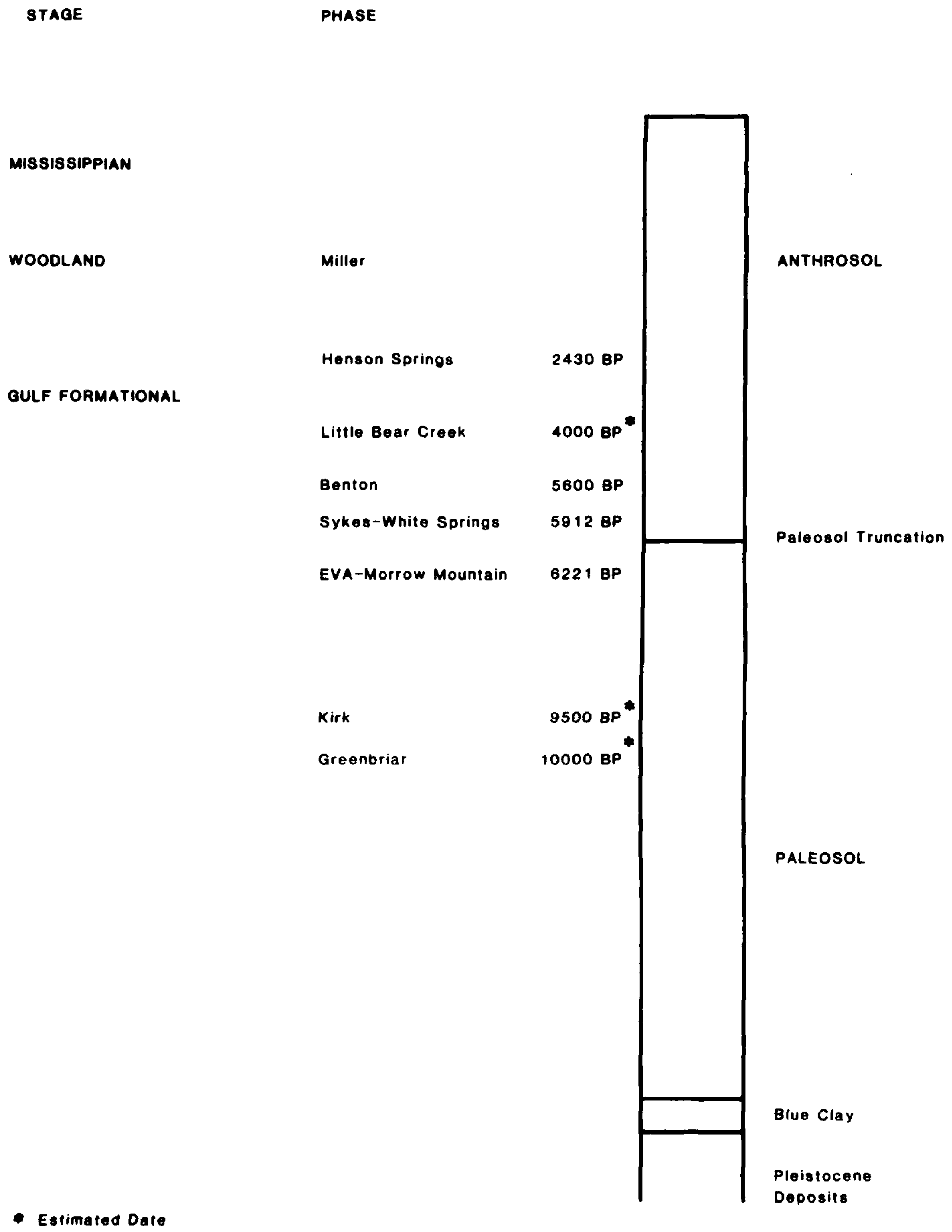


Figure 58 Sequence of events of floodplain midden mound sites.

TABLE 151
Cultural chronology of the Upper Tombigbee Valley.

Stage	Period	Culture	Phase	Dates B.P.	
				range	median
Paleo-Indian	Late			12,000-10,000	
Archaic	Early	Kirk	Poplar	10,000-7,500	
	Middle	Eva-Morrow Mountain	Hickory	7,400-6,200	7,000
		Sykes-White Springs	Walnut	6,100	
		Sykes-White Springs/ Benton	Walnut	6,000-5,840	5,900
		Benton	Walnut	5,700-5,300	5,530
	Late	Little Bear Creek		5,300-3,500	
Gulf Formational	Middle	Wheeler	Broken Pumpkin	3,500-2,500*	
	Late	Alexander	Henson Springs	2,500	
Woodland	Middle	Miller		2,000-700*	
Mississippian				700-500*	

* estimated (all others from direct dates).

1. Initially, the sites were relatively stable floodplain landforms such as levees or point bars or outliers of fragments of the valley terraces. The general floodplain landscape was relatively unstable, and thick fluvial deposits were laid down, the upper portions of which contain cultural materials and signs of occupation during the Early and Middle Archaic periods (10,000 - 8,500 B. P.).

2. The landscape stabilized during the Eva/Morrow Mountain period (ca. 7,500 - 6,300 B.P.), and a soil formed with identifiable A, structural B, and C horizons.

3. Xeric conditions, which caused desiccation cracks and a polygonal network in the soil which permeated the existing structure, ensued during the Sykes-White Springs/Benton periods (ca. 6,300 - 5,000 B.P.).

4. An onset of humid conditions (ca. 5,000 - 4,500 B.P.) caused flooding and scoured off the A and exposed the B horizons of the paleosol.

5. Deposition resumed, although at decreasing rates, until the present. Cultural materials contained in the basal deposits of these new sediments are Sykes-White Springs/Benton.

CULTURAL ADAPTATIONS

Several hypotheses pertaining to the adaptations made by the Archaic populations to the environment and resources of the Upper Tombigbee Valley were tested in this project. The hypotheses were actually on two levels: those specific to the lithic assemblages recovered and those specific to all cultural information recovered.

LITHIC SPECIFIC HYPOTHESES

OVERALL HYPOTHESES

The hypotheses addressed the nature of initial settlement, adaptive changes, and the possible causes of observed differences in the archaeological record during the Middle-Late Archaic and Late Archaic-Gulf Formational interfaces. Testing the overall hypotheses used all the lines of information produced in the project.

The first hypothesis tested concerned the nature of the initial settlement and occupation of the Upper Tombigbee Valley (Kirk through Eva-Morrow Mountain occupations). It was postulated that the settlement was generalized and became increasingly refined through time. The hypothesis was generally supported by documentation of an increase in density and diversity of cultural material and site use through the Early and Middle Archaic (Kirk through Benton). The four investigated sites of the Early Archaic appear to have been used intermittently, and few site features (10) were recovered. The largest feature type was the chipped stone clusters associated with stone tool manufacture and repair. Site use apparently was short-term campsites associated with hunting and tool production and maintenance.

The expectation that early occupations of the valley would exhibit use of specialized tools of higher quality raw materials than those of generalized tools was not supported. The abundant locally available chert was used for both specialized and general bifacially manufactured tools, and this pattern changed little through time. The locally available ferruginous sandstone was used for abrading and anvil purposes throughout the Archaic, and it was used with increasing frequency, especially during the Eva-Morrow Mountain period.

The second set of hypotheses addressed the transition and adaptive changes during the Middle Archaic (Eva-Morrow Mountain and Sykes-White Springs/ Benton). Alternative hypotheses concerning the development of the intense occupation of the midden mount included: 1) development out of the preceding Eva-Morrow Mountain period, 2) intrusion by an outside group, and 3) diffusion of ideas from an outside area. Studies indicated that portions of two hypotheses were supported. Lithic studies suggest that there is sufficient continuity in the assemblages of these components to indicate that population displacement did not occur.

The hypothesis that the change in lithic raw materials used to manufacture bifaces in the Benton period was due to lithic resource depletion was not supported. Studies conducted in the area indicate that while occupation of the floodplain sites did intensify ca. 6,000-7,000 B.P., and floodplain gravel bars were being buried in the Tombigbee Valley, there were sufficient supplies of lithic raw material were available. High quality raw materials were available throughout the prehistoric period in the exposed tributary stream valleys adjacent to the floodplain.

The change in raw materials occurred during the Benton period when Fort Payne chert quarry blanks or preforms imported from the Middle Tennessee Valley were almost exclusively worked into finished bifaces. Fort Payne chert had previously been imported and used, but at a frequency of less than 5%. Finished tools of Fort Payne in these early periods were rare. During the Sykes-White Springs/Benton periods, use of Fort Payne chert increased to approximately 15%. Other tools continued to be manufactured from local cherts. The real change in raw material to Fort Payne chert was in that used for biface manufacture. Comparisons to post-Benton assemblages could not be made because of the lack of integral material.

Threads of continuity run through the assemblages during the 4,000-5,000 years duration of these Archaic periods. The stylistically sensitive artifacts (hafted bifaces) of the Early Archaic through Sykes-White Springs are relatively similar in method of manufacture and notching technique. Differences do exist, however, in the flaking of preforms. Preforms for Greenbriars and Kirks required an additional series of flakes as compared to Evas, Morrow Mountains, and Cypress Creeks. Sykes-White Springs forms were manufactured in a very similar manner to Greenbriars and Kirks, although they were the most complex to manufacture.

It was hypothesized that the big base camps of the Sykes-White Springs/Benton period were occupied year round. The paucity of macrobotanical remains did not allow confident testing of this hypothesis. The plant remains from all locations were dominated by charred nutshell fragments, especially hickory. Other plant remains, especially seeds and cane were recovered at several sites. These spring, summer, and fall seasonal indicators were not bultressed by macrobotanical signs of winter occupance. Preservation was poor, however, and the hypothesis of year-round occupation of the sites cannot be dismissed.

The lithic studies also addressed population mobility during the Middle Archaic. The expected attributes in the lithic assemblages which would reflect a decrease in mobility from pre- and post-Benton occupations were not present. This included attributes relevant to technological efficiency, raw material use, tool complexity, or tool standardization. There were some changes through time seen on the assemblage level, such as an increase in ground stone use and increase in density of lithics. The highest artifact density was present in the Middle Archaic Eva/Morrow Mountain period. The primary characteristics of the lithic assemblages as measured by the specific artifact attributes or assemblages at all sites and in all time periods examined were HOMOGENEITY and STABILITY.

The third hypothesis tested in the lithic studies was a set of alternatives addressing the cause of the "Benton phenomenon": trade, immigration, or changes in socio/political organization. The studies supported the hypothesis that trade in lithic raw material, specifically Fort Payne chert, was directly correlated with the Sykes-White Springs/Benton period. Trade in this raw material had been conducted in limited amounts prior to this period. The importation of large numbers of quarry blanks (preforms), which were then finished into bifaces, added a new dimension to the trade. The quarry blanks were often cached and showed edge blunting from travel, and surfaces were polished from rubbing during transportation. In addition, the associated preforms were often made from the same core or "block." Although information on the post-Benton assemblages is very limited, it appears that trade in these quarry blanks decreased markedly, and bifaces were again made of local chert.

Alternative hypotheses concerning immigration of outside groups and socio/political changes were not supported. Other than a change in raw material for biface manufacture, homogeneity and continuity were documented throughout the Archaic lithic assemblages.

The next hypothesis tested was the nature of the transition from the Middle Archaic to the Late Archaic (Benton to Little Bear Creek). Two alternative hypotheses were tested relating to natural evolutionary change and the departure of the possible intrusive group and a return to the pre-intrusive way of life. The intrusive group hypothesis was effectively dismissed, whereas the second hypothesis was supported, although the one intact Little Bear Creek component provides marginal support. There are several differences between Benton and Little Bear Creek components, i.e., elimination of imported quarry blanks for bifaces, change in biface manufacture to small local cobbles and elimination of the large multi-hearth prepared areas. The Little Bear Creek component was present at 10 sites, but the midden was mixed and assemblages could not be identified except at one site (22It623/22It624). At the sites with mixed Late Archaic middens, the number of Little Bear Creek bifaces was usually high, and probably indicates both continued site use during this period and the physical strength of this type point.

Several research questions were also asked in this study on the descriptive level rather than the explanation level of hypotheses. The first question focused on the Henson Springs phase component ceramic assemblage recovered from 22It563. The detailed modal analysis documented that this assemblage is from the earlier portion of the span of time during which the Alexander series was produced (ca. 600 B.C.). Incising motifs were quite varied in the ceramic assemblage, with 36 variations documented. However, punctating was dominant and indicates overlap with earlier decorative motifs. Modal analysis provided a data set of an early Alexander ceramic assemblage that can be used in future comparative studies.

The second research question concerned the Woodland ceramic sequences. The small ceramic assemblage from 22Mo531 was characterized as standard Miller I and seriated to have been made between A.D. 1 and A.D. 300. The Late Woodland ceramic assemblage from 22It606 was classified as Miller III. This was one of the first Late Woodland ceramic assemblages from the Upper Tombigbee Valley to undergo formal modal analysis. These subphases, located 65-100 km (40.3-62 mi) from the defined examples, exhibited expected and documented differences. The Upper Tombigbee Miller III assemblage differences included frequent smoothing of cord-marked surfaces, inclusion of bone along with grog as a tempering agent, and a higher percentage of shell-tempered pottery. The assemblage was similar to other terminal Woodland ceramics in that the major types are the same, and shell- and grog-tempered pottery have similar shapes. The radiocarbon dates of this Miller III ceramic assemblage extends to A.D. 1,200, which is 100 years later than those dates in the central portion of the Tombigbee Valley.

MODEL OF ADAPTIVE SYSTEMS IN THE UPPER TOMBIGBEE VALLEY
(10,000-5,000 B.P.)

The investigations conducted in this project in the Upper Tombigbee Valley of the mid-South have produced information which can now be integrated and interpreted into a model of Archaic adaptations and adjustments. A summary elucidation of this model follows.

LATE PALEO-INDIAN STAGE
(13,000-10,000 B.P.)

The Upper Tombigbee Valley in the period of early post-glacial climate was deeply incised and then rapidly filled in response to the fall and subsequent rise in sea level. The floodplain was likely sparsely vegetated with open areas of coarse sandy material. The Tombigbee was probably a braided stream.

Backwater areas did exist where quiet bodies of water deposited fine clays. There were many landforms in the floodplain suitable for human occupation, such as point bars, parallel bars, and levees along the many streams. The temperature was cooler and moister than today, but warmer that during the previous periods. Occupation was initiated in the Upper Tombigbee Valley in this kind of physical environment during the late Paleo-Indian stage. Evidence of this occupance was recovered at four sites investigated 22It539 (two Daltons), 22It576 (one Quad and two Daltons), 22It590 (five Daltons), and 22It621 (one Cumberland). Unfortunately, all of these temporally sensitive bifaces were found out of context. However, the presence of these artifacts does document that this area was occupied during this stage, most likely at these sites. It is important to note that all of the sites containing late Paleo-Indian markers were also occupied during the Early Archaic. If presence and frequency indicate relative age and density of occupation, the Hickory site (22It621) was occupied first, followed by the Poplar site (22It576). The Ilex site (22It590) had the most intense Dalton occupation, followed by the Poplar and Walnut (22It539) sites. The most important aspects of the late Paleo-Indian occupation are:

1. The selection of the floodplain for occupation
2. High correlation with Early Archaic occupation
3. Low density of cultural material
4. The landscape was dynamic and unstable

There are conflicting hypotheses explaining the low number of Paleo-Indian sites. Muto and Gunn (1985) state that there was severe flooding of the valley approximately 10,000 B.P. which effectively scoured away most Paleo-Indian remains. Pettry agrees that a scouring episode occurred, but he places it much earlier - in the Pleistocene period. Pettry predicts that the lower deposits of the paleosol deposits, which are culturally sterile, were laid down in the Late Pleistocene. A major scouring episode was not observed in the paleosol at the sites investigated, but such scouring occurred beneath it. If Pettry is correct, the sediments of Paleo-Indian age, at least at these sites, were present and had not been eroded away. However, Alexander (1983b) has dated an erosional episode at 9,030±340 B.P. above 22It590 and 22Ts954. Based on the materials recovered in this study, this occupation was light and was not present below the Early Archaic deposits in the areas excavated. A brief review of all sites identified in Itawamba County in the Tombigbee Valley revealed that there were no other Paleo-Indian components discovered, and all were in floodplain environments. This leads to the hypothesis that Paleo-Indian occupation of the Upper Tombigbee Valley was minimal and limited to the floodplain.

In considering conflicting Pettry and Muto and Gunn theses, the evidence recovered supports Pettry. However, the original depositional context of these markers was not documented in this study, and the specimens could have been curated or obtained from other sites outside the floodplain. Further research is necessary to resolve the issue.

EARLY ARCHAIC STAGE
(10,000 - 7,500 B.P.)

The environmental conditions during the Early Archaic period were similar to those of the preceding one. However, during this period, several trends culminated. First, the floodplain was "filling up" with loose coarse sediments, and the local relief was diminishing. Elevations were being buried under alluvium, while others were becoming better defined. The Tombigbee and larger floodplain tributaries began to occupy more stable courses. As a result, resident populations were restricted to potential site localities which protruded well above the floodplain. Deposits during this period continued to be coarse, sandy loams.

Remains of the Early Archaic were the earliest intact deposits encountered in these investigations. Components were present in seven of the sites investigated, five of which had intact middens (22It539, 22It576, 22It590, 22It621, and 22It623/22It624), but one of these was not sampled (22It623/22It624). All sites were located on the floodplain, and all material was contained in the same paleosol unit. The cultural material consisted primarily of lithic material, and 17 features (12 pits and five chipped stone clusters) could be associated (Table 148). The assemblages at each site have individual differences in size and composition. It appears that all were short-term campsites. The chipped stone clusters unique to the Poplar site appear to be well-preserved remnants of tool manufacture for "retooling" activities. This implies that exposed cobbles were available nearby. Such cobbles are not available today, suggesting that the Early Archaic floodplain is buried.

The activities inferred from the functional analysis of the lithic assemblages can be associated with hunting, meat processing, stone working, and wood working. Ground stone is not frequently found in these assemblages.

The matrix of the assemblages is a coarse sandy loam containing little organic material. Charcoal was scarce and limited to charred hickory nutshells. The sediments developed into a soil with a polygonal cracked and filled network. However, these characteristics developed after the Early Archaic occupations.

From the information recovered from the Early Archaic deposits the following refined hypotheses are proposed:

1. The environment was gradually warming.
2. The landscape was stabilizing through rapid filling and stream channel maturity.
3. Lithic raw materials in the floodplain were being buried, and well-drained elevations suitable for occupation were decreasing in number.
4. The Early Archaic populations were the first to inhabit the floodplain regularly.
5. The sites were used for short-term occupation by small groups.
6. Tool manufacturing, tool kits, and tool function established during this period were to continue for the duration of the Archaic.

MIDDLE ARCHAIC STAGE
(7,500-5,000 B.P.)

During the Middle Archaic in the Upper Tombigbee Valley a change in the adaptive strategy of the population is documented. The landscape apparently stabilized during the Eva period (7,500-6,300 B.P.). After stabilization, xeric conditions developed. Mesic conditions returned subsequently, and flooding occurred approximately 6,300 B.P. throughout the floodplain. The upper portion of the soil was removed, and deposition resumed. This deposition has continued to the present, although at a diminishing rate.

There are clear indications that cultural adjustments were made to adapt to the changing environmental and landscape conditions. The sites occupied during the Early Archaic continued to be occupied. However, the use of these sites changed. The dramatic rise in numbers and kinds of features beginning in the Eva-Morrow Mountain period (Table 146) testifies to those changes. The 33 features include storage, cooking and habitation facilities, work areas, and burials with grave goods possibly organized in a cemetery, as well as a cremation containing zoomorphic beads.

This pattern of site use intensified in the following Sykes-White Springs/Benton period and probably indicates both a larger site population and longer term site use. These deposits containing these materials rest uncomformably on the truncated paleosol. Seven components were investigated. Two were intensely occupied floodplain base camps (22It539 and 22It576), four were smaller floodplain camps (22It590, 22It623/22It624, 22It622, and 22It621), and one was an overlook of the floodplain (22It606). A total of 159 features were associated with these settlements, far more than with any other period of occupation. The features include large refuse pits, prepared hearth areas (fired aggregates), large prepared clay with multiple hearths, burials, and a full range of other feature types. This occupation is clearly distinct from any other in the Upper Tombigbee.

In addition to the dramatic increase in the number of features, the matrix surrounding them was highly altered. The Sykes-White Springs/Benton deposits were organically enriched to the extent that they are still dark brown and greasy. There was an increase in charcoal (especially wood and charred hickory nutshells) from almost nothing to up to 13% of the cubic volume of the midden. As the upper paleosol containing the Eva-Morrow Mountain component has been discolored by organics moving down from above, the original characteristics of the midden were difficult to measure. It appears, however, that organics and charred plant material are more abundant than in the previous Early Archaic midden, but less so than in the following Sykes-White Springs/Benton. The erosion of the upper portion of this deposit, which contained a dark midden (A) and cultural material, precludes a determination of other possible assemblages.

The hypotheses which can now be generated concerning the Middle Archaic occupation in the Upper Tombigbee Valley follow:

1. The environment continued to warm and reached a peak of aridity ca. 7,500-6,300 B.P. Stream regimens and the geomorphic landscape stabilized.

2. Humid conditions ensued initiating a flooding episode which scoured even the highest elevations in the floodplain, and subsequent deposition has continued to present.

3. Cultural adjustments to these conditions were made by the occupants initially during the Eva/Morrow Mountain period, and these adjustments intensified during the Benton period. These changes included longer residence by more people, the use of a few semipermanent main base camps, and the occupance of smaller sites for more specialized purposes.

4. These adaptations to the floodplain probably relates to increasing warmth and dry conditions of the Altithermal climate episode. The uplands apparently were not capable of providing the previous subsistence support, which forced (or "pulled") people into the floodplain.

LATE ARCHAIC STAGE
(5,000 - 2,500 B.P.)

The environment from the onset of more humid conditions, approximately 6,300 B.P., signaled the amelioration of post-glacial climate. Most paleoenvironmental research (Delcourt 1979; Whitehead 1973) agree that modern conditions were reached approximately 5,000 years ago. Paleoenvironmental data acquired in this study cannot confirm or deny these assumptions. The cultural information recovered in this project reflects a change in floodplain site use at this same time.

Site disturbance of post-Benton cultural material at the sites investigated calls the nature of the transition to the Late Archaic and following into question. It appears that the initial Late Archaic component is Little Beak Creek. However, it is not possible to document the assumption. The stylistic bifaces of this period were above the Benton components, but in nine instances, they were mixed and contained material from other periods. In the one site (22It623/22It624) which contained both a Benton and Little Beak Creek assemblage, there is a smooth transition between them.

The Little Bear Creek component included six features. Five were refuse pits similar to those associated with the Benton occupation at this site, but there also was a ceremonial blade cache with chert imported from the Midwest, as well a green siltstone atlatl weight. These were not present in any other assemblage. No major changes were documented in the lithic assemblages either, and, from all indications, there was cultural continuity between these periods.

Site use apparently changed. No longer are the large prepared areas constructed nor does the midden contain as much charcoal from fires. Prepared hearths, so frequent in the previous periods (40), were not found, nor were burials encountered from this period. The available limited data suggest that there was an adjustment to the improving conditions and an increased mobility, although the floodplain area continued to be used and occupied.

The hypotheses concerning the adaptations or adjustments made by the Late Archaic population in the Upper Tombigbee Valley follow:

1. The onset of more mesic conditions following the xeric Altithermal period reduced the need for the nucleated settlement pattern of the Middle Archaic. Populations became more dispersed, and site use was more homogeneous.

2. Subsistence resources on the valley terraces and in the uplands became available again and were incorporated into the subsistence round.

3. Ceremonial practices changed to include the use and destruction of exotic bifaces.

GULF FORMATIONAL STAGE
(2,500-2,000 B.P.)

By the time of the Gulf Formational, modern environmental conditions had become established, and the Upper Tombigbee Valley had a physical, biological, and climatological milieu, much like extant conditions. Ten components of the Gulf Formational stage were encountered in this study. These included both Wheeler (middle) and Henson Springs (late horizon components). One undisturbed Henson Springs phase midden was identified at the Aralia site

(22It563), and 17 features at five sites were also recovered. The Aralia site provided the primary source of information for this period. The information from this assemblage indicated that Aralia was a base camp at which multiple activities took place. These included stone tool manufacture, food processing, and wood and hide processing. Stone tool manufacturing techniques now included the splitting of small cobbles by the anvil technique to manufacture bifaces. Separate activity areas were identified by midden stains and concentrations of different cultural materials.

Continuity with previous periods was documented by all material gathered on the Gulf Formational stage. An increased reliance on seeds and acorns, which are considered a second-line food resources, suggests some stress on available food resources. Trivial adjustments were surely made to minor environmental and population level fluctuations.

WOODLAND AND MISSISSIPPIAN STAGES
(2,000-500 B.P.)

Woodland occupations were documented at all of the sites investigated. These included floodplain and first terrace positions as well as an upland overlook site. All of the middens had been disturbed, however nine sub-midden features were encountered at 22It606, and two were identified at 22It576. In addition, a burial mound from the Middle Woodland stage was investigated (22Mo531).

The burial mound provided the only information on the Middle Woodland. It contained a Miller I ceramic assemblage which was similar to that of the Central Tombigbee Valley. The actual burials were not encountered, since historic burials intruded. Hence, little information on this period was recovered.

Information on the Late Woodland period was recovered from 22It606. It appears that maize, although present, was not a diet staple of those occupants. Wild foods, similar to those of previous periods, was the dominant form of subsistence remains. The ceramic assemblage was identified as Miller III and was different in surface treatment and tempering from those of the central part of the valley. Radiocarbon dates also suggest that these ceramic types were in use for at least 100 years longer than further downstream in the central valley.

The Mississippian occupation of the Upper Tombigbee Valley was not well represented, although shell-tempered pottery was recovered at six sites. This study provided little information on the activities conducted during this stage in the Upper Tombigbee Valley. In addition, the knowledge of these later stages of prehistoric occupation of the Upper Tombigbee Valley is also limited by the lack of intact deposits. There is a fertile field for future research to address the nature of the use of valley resources in relation to the large agricultural Mississippian villages in the uplands near Tupelo.

RECOMMENDATIONS FOR FUTURE RESEARCH

Studies performed as a part of the salvage excavations have yielded significant data. The adaptive processes employed by Archaic populations are well documented and can serve as a basis for further studies into understanding the relationship of human occupance to changing climatic conditions. A study of prehistoric adaptations in adjacent upland areas is essential to provide comparisons and contrasts with floodplain occupance.

Although archaeologists have long disregarded materials which are documented to contain mixed temporal markers, as was done in this study, it is essential to initiate investigation of such sites. Available information could be compared to that from the Archaic. Such temporally mixed deposits contained the bulk of the recovered material, and important information is contained in them. The presence of ceramics, the compressed time of ceramic technology, and surface treatments actually predisposes these archaeological deposits to be described as "disturbed" by the archaeologist. Archaic deposits exhibit an opposite effect. The stylistic bifaces, which are temporal markers, have shown long periods of use, and the reasons for change are still uncertain. The Archaic components, which span thousands of years, may be more "mixed" than Woodland or Mississippian components which span hundreds of years. The thousands of available specimens from these later stages should be intensively studied.

Information from all the midden mounds in the Tombigbee and Tennessee floodplains should be compiled and analyzed. A cursory review of the excavation reports reveals striking similarities over a 7,000 year span. Analysis of several studies may yield broadly applicable generalizations concerning site selection and use in floodplain milieux over protracted periods.

The Benton period in the Middle Tennessee and Upper Tombigbee Valleys should be intensively studied. The Walnut phase in the Tombigbee and the Seven Mile phase in the Tennessee Valley are quite similar. They appear to have been involved in heavy trading of Fort Payne chert. The nature of trade commodities, volume, and intensity may be revealing of differences or similarities between the two areas.

One of the most fruitful areas for future research involves further analysis of information already produced. Far more data were produced than could be analyzed within the scope of this project. Examples for further analysis include statistical analysis of the ceramic data and spatial analysis of the midden and feature data.

These collections are capable of answering many additional questions on the nature of the prehistoric adaptations in the mid-South. The midden mound materials have contributed uniquely to the void in our understanding of early human occupation of this region. Artifacts recovered can provide the grist for more definitive interpretations in future research.

REFERENCES

Abu-Agwa, F.
1982 Paleosols in the buried stream valleys of the loessial region of Mississippi. PhD. dissertation. Agronomy Department, Mississippi State University.

Adovasio, J.M., J. Donahue, H.B. Rollins, J.L. Yedlowski, and R.C. Carlisle
1979 Data recovery of five rock shelters on the Tennessee-Tombigbee Waterway. Paper presented at the Tennessee-Tombigbee Coordination Meeting, Columbus.

Ahler, Stanley A.
1970 Projectile point form and function at Rogers Shelter. Missouri Archaeological Society Research Series, 8.

1975 Pattern and variety in extended coalescent lithic technology. PhD. dissertation, Department of Anthropology, University of Missouri. Columbia University Microfilms, Ann Arbor.

1984 Stone Tool Analysis in the Elbee. Report submitted to the National Park Service.

Ahler, Stanley A. and Robert C. Christensen
1983 A pilot study of Knife River flint procurement and reduction at Site 32DU508, a quarry and workshop location in Dunn County, North Dakota. Contribution 186, Department of Anthropology and Archaeology, University of North Dakota, Grand Forks.

Alexander, Lawrence S.
1983a Phase I Archaeological Reconnaissance along the Tuscumbia River Watershed, Alcorn and Prentiss Counties, Mississippi. Office of Archaeological Research, University of Alabama. Report of Investigations 40.

1983b The archaeology of the Emmett O'Neal site (22Ts954) in the Bay Springs Lake segment of the Tennessee-Tombigbee Waterway, Tishomingo County, Mississippi. Office of Archaeological Research, The University of Alabama. Report of Investigations 37.

Allison, L.E.
1935 Organic soil carbon by reduction of chromic acid. Soil Science 40:311-320.

Amick, Daniel S.
1984 Lithic raw material variability in the central Duck River Basin: reflections of Middle and Late Archaic organizational strategies. Unpublished Master's thesis. Department of Anthropology, University of Tennessee, Knoxville.

Anderson, David G.
1979 Prehistoric selection for intentional thermal alteration: tests of a model employing southeastern archaeological materials. Midcontinental Journal of Archaeology 4:221-254.

Antevs, Ernst
1962 Late Quaternary Climates in Arizona. American Antiquity 28:193-99.

Asch, N.B., R.I. Ford, and D.L. Asch
1972 Paleoethnobotany of the Koster site: the Archaic horizons. Illinois State Museum. Report of Investigations 24.

Association of Official Analytical Chemist (AOAC).
1975 Official methods of analysis, 12th edition. Sec. 2.019-2.036.

Atkins, Steve and Jeannie MacMahan
1967 The Zabski site, Merritt Island, Florida. Florida Anthropologist 20:133-145.

Atkinson, James R.
1974 Appendix A: Test excavations at the Vaughn Mound site. In Archeological Survey and Test Excavations in the Upper-Central Tombigbee River Valley: Aliceville-Columbus Lock and Dam and Impoundment Areas, Alabama and Mississippi, edited by Marc D. Rucker, pp. 115-158. Report submitted to the National Park Service by the Department of Anthropology, Mississippi State University.

1978 A cultural resources survey of selected construction areas in the Tennessee-Tombigbee Waterway. Alabama and Mississippi, vol. 1. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Department of Anthropology, Mississippi State University.

Atkinson, James R. and Jack D. Elliott, Jr.
1978 A Cultural Resources Survey of Selected Construction Areas in the Tennessee-Tombigbee Waterway: Alabama and Mississippi. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Department of Anthropology, Mississippi State University.

Atkinson, James R., John C. Phillips and Richard Walling
1980 The Kellogg village site investigations, Clay County, Mississippi. Report submitted to U.S. Army Corps of Engineers, Mobile District by the Department of Anthropology, Mississippi State University.

Bartram, William
1928 Travels of William Bartram, edited by M. Van Doren. Dover Press.

Behn, Jeffrey A. and William Green
1982 Collections from the Copperas Creek site (11-F-100), a multicomponent site in the Central Illinois Valley. Rediscovery 2. Illinois Association for the Advancement of Archaeology.

Bense, Judith A.
1982 Archaeological testing investigations at 58 sites in the River and Canal Sections of the Tennessee-Tombigbee Waterway. Report submitted to the National Park Service by the Office of Archaeological Research, University of Alabama.

1983a Archaeological Investigations at Site 22It581, Itawamba County, Mississippi. Report submitted to the National Park Service by the Office of Archaeological Research, University of Alabama.

1983b *Archaeological investigations in the Upper Tombigbee Valley, Mississippi: Phase I*. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Cultural and Archaeological Research, University of West Florida.

Bicchieri, M.G.
1972 *Hunters and Gathers Today*. Holt, Rinehart, and Winston.

Binford, Lewis R.
1972 *An Archaeological Perspective*. Seminar Press, New York.

1977 Forty-seven trips: a case study in the character of archaeological formation processes. In *Stone tools as cultural markers: change, evolution, and complexity*, edited R.V.S. Wright, pp. 24-36. Prehistory and Material Culture Series 12. Australian Institute of Aboriginal Studies, Canberra.

1978 Dimensional analysis of behavior and site structure: learning from an Eskimo hunting stand. *American Antiquity* 43:330-361.

1979 Organization and formation processes: looking at curated technologies. *Journal of Anthropological Research* 35(3).

1980 Willow smoke and dogs' tails: hunter-gatherer settlement systems and archaeological site formation. *American Antiquity* 45:4-20.

1981 *Bones: Ancient men and modern myths*. Academic Press.

1982 The Archaeology of Place. *Journal of Anthropological Archaeology* 1:5-31.

1983 Long-term land use patterns: some implications for archaeology. In *Lulu Linear Punctated: Essays in Honor of George Irving Quimby*, edited by R.C. Dunnell and D.K. Grayson, pp. 27-53. University of Michigan, Museum of Anthropology.

Binkley, Kenneth M.
1978 *Excavation of Eleven Archaic and Woodland Sites in the Divide-Cut Section of the Tennessee-Tombigbee Waterway, Tishomingo County, Mississippi*. Department of Sociology and Anthropology, Center for Archaeological Research, University of Mississippi.

Blakeman, Crawford, H.
1975 *Archaeological investigations in the Upper-Central Tombigbee Valley: 1974 season*. Report submitted to the National Park Service by the Department of Anthropology, Mississippi State University.

1976 *A cultural resource survey of the Aberdeen Lock and Dam and Canal Section areas of the Tennessee-Tombigbee Waterway: 1975*. Report submitted to the National Park Service by the Department of Anthropology, Mississippi State University.

Blakeman, Crawford H., James R. Atkinson, and G. Gerald Berry
1976 Archaeological excavations at the Cofferdam site, 22Lo599. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Department of Anthropology, Mississippi State University.

Bohannon, Charles H.
1972 Excavations at the Pharr Mounds, Prentiss and Itawamba Counties, Mississippi and excavations at the Bear Creek site, Tishomingo, Mississippi. National Park Service, Office of Archaeology and Historic Preservation, Division of Archaeology and Anthropology, Washington, D.C.

Boydston, Roger A. and R. Lurie
1984 Experiments with limestone pestles: inferences for the Midwest Archaic. Paper presented at the 49th Annual Meeting, Society for American Archaeology, Portland.

Bremmer, J.M.
1960 Determination of nitrogen in soil by the Kjeldahl method. Journal of Agricultural Science 55:1-23.

Brink, John W.
1978 An experimental study of microwear formation of end scrapers. National Museum of Man, Mercury Series, Archaeological Survey of Canada, 83.

Brookes, Samuel O.
1979 The Hester site: an Early Archaic occupation in Monroe County, Mississippi. Mississippi Department of Archives and History, Archaeological Report 5.

Brose, David S.
1975 Functional analysis of stone tools: a cautionary note on the role of animal fats. American Antiquity 40(1):86-93.

Brose, David S., Ned J. Jenkins, and Russell Weisman
1983 An archaeological reconnaissance of the Black Warrior/Lower Tombigbee Valley and Mobile Delta, Alabama. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Department of Geography and Geology, University of South Alabama.

Brown, James A. and Robert K. Vierra
1979 Overview of Koster site research. Paper presented at the 44th Annual Meeting, Society for American Archaeology, Vancouver.

1982 What happened in the Archaic? Introduction to an ecological approach to Koster site archaeology. In Archaic Hunters and Gatherers in the American Midwest: Multidisciplinary Studies in the Archaic, edited by James L. Phillips and James A. Brown, pp. 165-196. Academic Press.

Bullen, Ripley P.
1972 The Orange period of peninsular Florida. In Fiber-tempered Pottery in the southeastern United States and northern Columbia: its Origins, Context, and Significance, edited by R.P. Bullen and J.B. Stoltman, pp. 9-33. Florida Anthropological Society Publications 6.

Bullen, Ripley P. and Adelaide K. Bullen
1961 The Summer Haven site, St. Johns County, Florida. *Florida Anthropologist* 14:1-15.

Bullen Ripley P. and H. Bruce Greene
1970 Stratigraphic tests at Stallings Island, Georgia. *Florida Anthropologist* 23:8-28.

Buntley, G.J., R.B. Daniels, E.E. Gamble and W.T. Brown
1977 Fragipan horizons of the Memphis-Loring-Grenada sequence in West Tennessee. *Soil Science Society of American Journal* 41:400-407.

Caddell, Gloria May
1979 *Plant resources, archaeological plant remains, and prehistoric plant-use patterns in the central Tombigbee River Valley: Part I. Biocultural studies in the Gainesville Lake area.* Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama.

Caldwell, Joseph R.
1958 *Trend and tradition in the prehistory of the eastern United States.* American Anthropological Association, Memoir 88.

Callahan, Errett
1979 The basics of biface knapping in the eastern fluted point tradition: a manual for flint knappers and lithic and lithic analysists. *Archeology of Eastern North America* 7(1):661-683.

Cambron, James W. and David C. Hulse
1975 *Handbook of Alabama Archaeology, part I: point types.* Archaeological Research Association of Alabama, (revised).

Carlson, David L.
1979 Hunter-gatherer mobility strategies: an example from the Koster site in the lower Illinois valley. PhD. dissertation. Northwestern University, University Microfilms, Ann Arbor.

Chapman, Jefferson
1975 *The Rose Island site and the Bifurcate Point Tradition.* Report submitted to the Tennessee Valley Authority by the Department of Anthropology, University of Tennessee.

1977 *Archaic period research in the Lower Little Tennessee River Valley.* Report submitted to the Tennessee Valley Authority by the Department of Anthropology, University of Tennessee.

Chapman, Jefferson, Patricia Cridlebaugh, Lucy Foley, and Larry Kimball
1977 *Archaic Period Research in the Lower Little Tennessee River Valley.* Report submitted to the National Park Service by the Department of Anthropology, University of Tennessee. Report of Investigations 18.

Chapman, Jefferson and James Adovasio
1977 Textile and basketry impressions from Icehouse Bottom, Tennessee. *American Antiquity* 42(4):620-625.

Christenson, Andrew L.
1982 Maximizing clarity in economic terminology. *American Antiquity* 47:419-426.

Collins, Michael B.
1975 Lithic technology as a means of processual inference. In *Lithic technology: making and using stone tools*, edited by Earl Swanson, pp. 15-34. Aldine, Chicago.

Collins, Michael B. and Jason M. Fenwick
1974 Heat Treating of chert: methods of interpretation and their application. *Plains Anthropologist* 19 (64):134-145.

Connaway, John M., Samuel O. McGahey, and Clarence H. Webb
1977 *Teoc Creek: a Poverty Point site in Carroll County, Mississippi*. Mississippi Department of Archives and History, Archaeological Report 3. Jackson.

Cotter, John L. and John M. Corbett
1951 *Archaeology of the Bynum Mounds, Mississippi*. National Park Service, Archaeological Research Series 1.

Crabtree, Don E.
1974 Grinding and smoothing of stone artifacts. *Tebiwa* (17)1:1-47.

Crabtree, Don E. and B. Robert Butler
1964 Notes on experiments in flintknapping: 1. heat treatment of silica minerals. *Tebiwa* 7(1):1-6.

Cridelbaugh, Patricia A.
1977 An analysis of the Morrow Mountain component at the Icehouse Bottom site and a reassessment of the Morrow Mountain Complex. Unpublished Master's Thesis. Department of Anthropology, University of Tennessee.

Curren, Caleb B.
1979 An archaeological survey of the Warrior Valley in Tuscaloosa County, Alabama. Site forms on file at Mound State Monument, Moundville.

Davis, R.P. Stephen Jr., Larry R. Kimball, and William W. Baden (editors)
1982 An archeological survey and assessment of aboriginal settlement within the lower Little Tennessee River Valley. Final Report submitted to the Tennessee Valley Authority.

Day, P.R.
1965 Particle fractionation and particle size analysis. In Methods of Soil Analysis, Part I., edited by C.A. Black. *Agronomy* 9:552-562. American Society of Agronomy, Madison, Wisconsin.

DeConick, F., D. Righi, J. Maucorps, and A.M. Robin
Origin and micromorphological nomenclature of organic matter in sandy Spodosols. In *Soil Microscopy*, edited by G.K. Rutherford, pp. 263-280. The Limestone Press, Kingston, Ontario.

DeJarnette, David L. John A. Walthall, and Steve B. Wimberly
1975 Archaeological Investigations in the Buttahatchee River Valley II: excavations at Stucks Bluff shelter. *Journal of Alabama Archaeology* 21:99-119.

Delcourt, H.R.
1979 Late Quaternary vegetation history of the eastern Highland Rim and adjacent Cumberland Plateau of Tennessee. *Ecological Monographs* 49(3):255-280.

Delcourt, Paul A. and Hazel R. Delcourt
1979 *Late Pleistocene and Holocene distributional history of the deciduous forest in the southeastern United States*. Veroffentlichung des Geobotanischem Institutes der ETH, Stiftung Rubel (Zurich) 68.

Dodd, Walter, A. Jr.
1979 The wear and use of battered stone tools at Armijo Rockshelter. In *Lithic Use-Wear Analysis*, edited by B. Hayden, pp. 231-242. Academic Press.

Dragoo, D. W.
1976 Adena and the eastern burial cult. *Archaeology of Eastern North America* 4:1-9.

Dye, David H.
1973 An Alexander phase in the Tennessee Valley and adjacent areas. Paper presented at the 30th Annual Meeting of the Southeastern Archaeological Conference, Memphis.

1977 A model of Late Archaic subsistence system in the Western Middle Tennessee Valley during the Bluff Creek Phase. *Tennessee Anthropolgist* 2:63-80.

1980 Primary Forest Efficiency in the Western Middle Tennessee Valley. Unpublished PhD. dissertation, Washington University.

Dye, David H. and Jerry R. Galm
1982 Alexander, Tchefuncte, and Black Sand: an early Gulf Tradition in the central Tombigbee Valley. Paper presented at the Third Annual Meeting of the Mid-South Archaeological Conference, Memphis.

Dye, David H. and Charlotte A. Watrin
1985 *Phase I and II Archaeological Investigations at the W.C. Mann site (22Ts565), Tishomingo County, Mississippi*. Report submitted to the U.S. Army Corps of Engineers, Nashville District by the Department of Anthropology, Memphis State University.

Earle, Timothy K. and Andrew L. Christenson (editors)
1980 *Modeling change in prehistoric subsistence economies.* Academic Press.

Eickmeier, Jan
1974 Use of Carbonized Seeds in Archaeological Seed Analysis. *Missouri Archaeological Society Newsletter* 283.

Elliott, Jack D., Jr.
1978 A cultural resources survey of selected construction areas in the Tennessee-Tombigbee Waterway: Alabama and Mississippi, Vol. 2. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Department of Anthropology, Mississippi State University.

Ensor, H. Blaine
1980 An evaluation and synthesis of changing lithic technologies in the Central Tombigbee Valley. *Southeastern Archaeological Conference, Bulletin* 22:83-90.

1981 Lithic morphology, technology, and use the central Tombigbee Valley drainage: the Miller II and Miller III phases. Unpublished Master's Thesis, Department of Anthropology, University of Alabama.

1982 *Gainesville Lake area lithics: chronology, technology, and use. Volume III of archaeological investigations in the Gainesville Lake area of the Tennessee-Tombigbee Waterway*. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama. Report of Investigations 13.

Fairbanks, Charles H.
1942 The taxonomic position of Stallings Island, Georgia. *American Antiquity* 7:223-231.

Fitzpatrick, E.A.
1980 *Soils*. Longman Inc., New York.

Flennikin, J. Jeffrey
1981 *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site.* Reports of Investigations 59. Laboratory of Anthropology, Washington State University.

Ford, James A.
1966 Early Formative Cultures in Georgia and Florida. *American Antiquity* 31(6):781-799.

Ford, James A., Philip Philips and William G. Haag
1955 The Jaketown site in west-central Mississippi. *American Museum of Natural History, Anthropological Papers* 46:1-164.

Ford James A. and George I. Quimby
1945 *The Tchefuncte culture, an early occupation in the Lower Mississippi Valley*. Society for American Archaeology, Memoir 2.

Ford James A. and Clarence H. Webb
1956 Poverty Point, a Late Archaic site in Louisiana. *American Museum of Natural History, Anthropological Papers* 46:1-136.

Futato, Eugene M.
1980 Chipped stone biface manufacture in the Bear Creek Watershed. *Southeastern Archaeological Conference Bulletin* 22:77-83.

1983 Patterns of lithic resources utilization in the Cedar Creek Reservoir area. *Southeastern Archaeology* 2(2):118-131.

Futato, Eugene M., G.M. Caddell, C. Gaylenhaal-Davis, H.S. Hale, K.R. Turner
1983 *Archaeological Investigations in the Cedar Creek and Upper Bear Creek Reservoir*. Report submitted to the Tennessee Valley Authority by the Office of Archaeological Research, University of Alabama.

Gagilana, Sherwood M. and Clarence H. Webb
1970 Archaic-Poverty Point transition at the Pearl River mouth. *Southeastern Archaeological Conference Bulletin* 12:47-72.

Galm, Jerry R.
1978 *The archaeology of the Curtis Lake site (34Lf58), LeFlore County, Oklahoma*. Research Series 2. Archaeological Research and Management, University of Oklahoma.

1981 Prehistoric Cultural Adaptions in the Wister Valley, east-central Oklahoma. Unpublished PhD. dissertation, Washington State University.

Goodyear, Albert C.
1979 *A hypothesis of the use of cryptocrystalline raw materials among Paleo-Indian groups in North America*. Research Manuscript Series 156. Institute of Archeology and Anthropology, University of South Carolina.

1982 Tool kit entropy and bipolar reduction: a study of interassemblage lithic variability among Paleo-Indian sites in the Northeastern United States. Unpublished Ms.

Gould, Richard A.
1978 The anthropology of human residues. *American Anthropologist* 80:815-835.

Gregg, Michael L. and Richard J. Graybush
1976 Thermally altered siliceous stone from prehistoric context: intentional versus unintentional alteration. *American Antiquity* 41:189-192.

Greenland, D.J., G.R. Linston, and J.P. Quirk
1961 Role of polysaccharides in stabilization of natural soil aggregates. *Nature* (London) 191:1283-1284.

Griffin, James B.
1952 Culture Periods in Eastern United States Archaeology. In *Archaeology of Eastern United States*, edited by J. B. Griffin. pp. 352-364. The University of Chicago Press.

1967 Eastern North American Archaeology: A Summary. *Science* 156:175-191.

1978 Eastern United States. In *Chronologies in New World Archaeology*, edited by R. E. Taylor and C. W. Meighan pp. 51-70. Academic Press.

Griffin John W.
1972 Fiber-tempered pottery in the Tennessee Valley. In *Fiber-tempered pottery in the southeastern United States and northern Columbia: its origin, context, and significance*, edited by R.P. Bullen and J.B. Stoltman, pp. 34-36. Florida Anthropological Society, Publication 6.

Griffith, M.A.
1980 A pedological investigation of an archaeological site in Ontario, Canada, I. An examination of the soils in and adjacent to a former village. *Geoderma* 24:237-336.

Grissinger, E.H. and J.B. Murphy
1982 Present "problem" of stream channel instability in the bluff area of northern Mississippi. *Journal Mississippi Academy Science* 27:117-118.

Grossman, R.B. and F.J. Carlisle
1969 Fragipan soils of the eastern United States. *Advances Agronomy* 21:237-239.

Hanson, Lee H. Jr.
1969 *Survey of Town Creek Watershed, Dam No. 46A, Lee County, Mississippi.* Report submitted to the Soil Conservation Service.

Harlow, William D.
1959 *Fruit Key and Twig Key to Trees and Shrubs.* Dover, New York.

Harradine, F.F.
1949 The variability of soil properties in relation to stage of profile development. *Soil Science Society American Proceedings* 14:302-311.

Hayden, Brian (editor)
1979 *Lithic use-wear analysis*. Academic Press.

Henry, Don O., C. Vance Haynes and Bruce Bradley
1976 Quantitative variations in flake stone debitage. *Plains Anthropologist* 21(71):57-61.

Hilgard, E.W.
1860 Report on the geology and agriculture of the state of Mississippi. Jackson, Mississippi.

Hill, Mary C.
1979 A skeletal analysis of the human burials from 9Cla62. In *Cemochechobee: archaeological investigations at the Walter F. George Dam Mound site, 9Cla62, Clay County, Georgia,* by Frank T. Schnell, Vernon J. Knight, Jr., and Gail S. Schnell. pp. 464-473. Report submitted to the U.S. Army Corps of Engineers, Mobile District and the Heritage Conservation and Recreation Service.

Hofman, Jack L.
1984 Contextual studies of the Middle Archaic component at Cave Springs in middle Tennessee. Unpublished Master's Thesis. Department of Anthropology, University of Tennessee, Knoxville.

Hoidenreich, C., A.R. Hill, D.M. Lapp, and S. Navaratil
1971 Soil and environmental analysis of the Robitaille site. In Palaeoecology and Ontario Prehistory, edited by W.M. Hurley and C. E. Hoindenreich. Department of Anthropology, University of Toronto Research Project 2:179-249.

Hole, F.D.
1975 Some relationship between forest vegetation and Padzol B horizons in soils of Menominee tribal land, Wisconsin, U.S.A. Soviet Soil Science 7:714-723.

Holzhey, C.S., R.B. Daniels and E.E. Gamble
1975 Thick Bn horizons in the North Carolina Plain: II. Physical and chemical properties and rates of organic additions from surface sources. Soil Science Society American Proceedings 39:1182-1187.

Holliday, V.T.
1985 Morphology of late Holocene soils at the Lubbock Lake archaeological site, Texas. Soil Science Society American Journal 49:938-946.

House, John H.
1975 A functional typology for Cache River project surface collections. In The Cache River archaeological project: an experiment in contract archaeology, edited by John H. House and Michael B. Schiffer. Arkansas Archeological Survey Research Series 8.

Hubbert, Charles M.
1977 A cultural resource survey of the Bay Springs segment of the Tennessee-Tombigbee Waterway. Report submitted to the National Park Service by the Office of Archaeological Research, University of Alabama. Report of Investigations 3.

Hudson, Charles
1976 The Southeastern Indians. University of Tennessee Press, Knoxville.

Hugie, V.K. and H.B. Passey
1964 Soil surface patterns of some semiarid soils in northern Utah, southern Idaho, and northeastern Nevada. Soil Science Society American Proceedings 28:786-792.

Jackson, M.L.
1956 Soil Chemical Analysis, Advanced Course. Published by author. Soil Science Department University of Wisconsin, Madison.

Jane, F.W.
1959 The Structure of Wood. A. and C. Black, London.

Jenkins, Ned J.
1974 Subsistence and settlement patterns in the Western Tennessee Valley during the transitional Archaic-Woodland period. Journal of Alabama Archaeology 20(2).

1975a Archaeological investigations in the Gainesville Lock and Dam Reservoir: 1974. Report submitted to the National Park Service by the Department of Anthropology, University of Alabama.

1975b The Wheeler series and southeastern prehistory. *Florida Anthropologist* 18:17-26.

1978 Prehistoric chronology of the lower Chattahoochee Valley. *Journal of Alabama Archaeology* 24:73-91.

1979 *Gainesville Lake ceramic description and chronology. Archaeological investigations in the Gainesville Lake of the Tennessee-Tombigbee Waterway.* Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama. Report of Investigations 12.

1981 *Gainesville Lake area ceramic description and chronology.* University of Alabama, Office of Archaeological Research, Report of Investigations 11.

1982a *Archaeology of the Gainesville Lake area: synthesis.* Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama. Report of Investigations 23.

1982b The Wheeler series: space, time, and external relationships. Paper presented at the Third Annual Meeting of the Mid-South Archaeological Conference, Memphis.

1983 Ceramic chronology along the lower Tombigbee River and Mobile Delta regions. Report on file at the University of South Alabama, Department of Geology and Geography.

Jenkins, Ned J., Cailup B. Curren, Jr., and Marc DeLeon
1975 Archaeological site survey of the Demoplois and Gainesville Lake navigation channels and additional construction areas. Report submitted to the National Park Service by the Department of Anthropology, University of Alabama.

Jenkins, Ned J. and Richard A. Krause
1986 *The Tombigbee Watershed in Southeastern Prehistory.* The University of Alabama Press, Tuscaloosa.

Jenkins, Ned J. and Christopher J. Peebles
1982 A seriation of Late Middle Woodland-Late Woodland features from the Gainesville Lake area. In *Archaeology of the Gainesville Lake area: synthesis by Ned J. Jenkins. Volume V of Archaeological Investigations in the Gainesville Lake area of the Tennessee-Tombigbee Waterway.* Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama. Report of Investigations 23.

Jennings, Jesse D.

1941 Chickasaw and earlier Indian cultures of northeast Mississippi. *The Journal of Mississippi History* 3:155-226.

1944 The archaeological survey of the Natchez Trace. *American Antiquity* 4:408-414.

Jenny, J.

1982 Model of a rising profile in Nile Valley alluvium and its agronomic and pedogenic implications. *Soil Science Society American Proceedings* 26:588-591.

Jochim, Michael

1976 *Hunter-gatherer subsistence and settlement: a predictive model.* Academic Press.

Johnson, Jay K.

1981 *Lithic Procurement and Utilization Trajectories: Analysis Yellow Creek Nuclear Power Plant Site, Tishomingo County, Mississippi, Volume II.* Report submitted to the Tennessee Valley Authority by the Center for Archaeological Research, University of Mississippi. Tennessee Valley Authority Publication in Anthropology 28.

Joslin-Jeske, Robert

1981 Economies in lithic use strategies: an example from Mound City. Ms. on file, Department of Anthropology, Northwestern University.

1982 Economies in raw material use by prehistoric hunter-gatherers. Paper presented at the 47th Annual Meeting, Society for American Archaeology, Minneapolis.

Kalin, Jeffrey V.

1981 Stem Point Manufacture and Debitage Recovery. *Archaeology of Eastern North America* 9:134-175.

Karwedsky, Rocert A.

1980 Archaeological investigations at the Pharr village and Mackey's Creek sites in northeast Mississippi. *Florida State University Southeast Conservation Archeology Center, Archaeological Research Report* 6.

Keeley, Lawrence H.

1974 Techniques and methodology in microwear studies: a critical review. *World Archaeology* 5(3):323-337.

1979 *Experimental determination of stone tool use.* University of Chicago.

1982 Hafting and retooling: effects on the archaeological record. *American Antiquity* 47:789-809.

Keeley, Lawrence H. and M.H. Newcomer

1977 Microwear analysis of experimental flint tools: a test case. *Journal of Archaeological Science* 4:29-62.

Kelly, Robert L.
1983 Hunter-gatherer mobility strategies. *Journal of Anthropological Research* 39:277-306.

King, Frances, B.
n.d. Key to Common Dicot Woods of central Illinois. Typescript.

King, J.E. and W.H. Allen, Jr.
1977 A Holocene vegetation record from the Mississippi River Valley, southern Missouri. *Quaternary Research* 8:307-323.

Klippel, Walter E. and William B. Turner
1983 Prehistory and Holocene land surface changes in the Nashville Basin. Paper presented at the 48th Annual Meeting of the Society for American Archaeology, Pittsburgh.

Knudson, Ruthann
1973 Organizational variability in late Paleo-Indian assemblages. Unpublished PhD. dissertation, Department of Anthropology, Washington State University.

Lafferty, Robert H. and Carlos Solis
1980 *Phase II testing of the Bay Springs segment of the Tennessee-Tombigbee Waterway.* Draft report submitted to Interagency Archaeological Services, Atlanta.

Laphan, M.H.
1932 Genesis and morphology of desert soils. *American Soil Survey Association Bulletin* 13:34-52.

Lee, Richard B. and Irving Devore (editors)
1968 *Man the Hunter.* Aldine, Chicago.

Lewis, Sheila D. and James D. Caldwell
1972 *Survey of the Tennessee-Tombigbee Waterway System, 1971-1972.* Manuscript on file with the Mississippi Department of Archives and History, Jackson.

Lewis, Thomas M.N. and Madeline Kneberg Lewis
1961 *Eva: an Archaic site*. University of Tennessee Press, Knoxville.

Lloyd, Janet R., Judith A. Bense and Jesse L. Davis
1983 Tallahatta quartzite quarries in the Escambia River Drainage. *Journal of Alabama Archaeology* 29(2):125-141.

Lowe, Ephraim N.
1915 *Mississippi: its geology, geography, soils, and mineral resources*. Mississippi State Geological Survey Bulletin 12.

1921 *Plants in Mississippi.* Mississippi State Geological Bulletin 17.

Lurie, Rochelle
1982a Economic models of stone tool manufacture and use: the Koster site, Middle Archaic. PhD. dissertation, Department of Anthropology Northwestern University, University Microfilms, Ann Arbor.

1982b A functional analysis of artifacts from some pre-ceramic components In Prehistory of the Ayacucho Basin (vol 4) by R.S. MacNeish, A. Nelkin-Turner, R.K. Vierra, R. Lurie, and A.G. Cook. University of Michigan Press, Ann Arbor.

1984 Raw material selection and reduction at the Oak Forest site. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland.

n.d. Lithic technology and mobility strategies: The Koster Middle Archaic. In Time, Energy and Stone Tools, edited by Robin Torrence, Cambridge University Press.

Lutz, H.J.
1951 The concentraion of certain chemical elements in soils of Alaskan archaeological sites. American Journal Science 249:925-928.

McComb, A.D. and W.E. Loomis
1944 Subclimax prairie. Bulletin Torrey Botanical Club 71:46-47.

McGahey, Samuel O.
1971 Archaeological survey in the Tombigbee River Drainage area, May-June 1970. Mississippi Archaeological Survey, Preliminary Report 2.

McKeague, J.A.
1968 Humic-fluvic acid ratio, Al, Fe and C in pyrophosphate extracts as criteria of A and B horizons. Canadian Journal Soil Science 48:27-35.

McMichael, Edward V. and James H. Kellar
1960 Archaeological salvage in Oliver Basin. University of Georgia, Laboratory of Archaeology Series, Report 2.

Magne, Martin and David Pokotylo
1981 A pilot study in bifacial lithic reduction sequences. Lithic Technology 10(2-3):34-47.

Mandeville, M.D. and J. Jeffery Flenniken
1974 A comparison of the flaking properties of Nehawka chert before and after thermal pretreatment. Plains Anthropologist 19(64):146-148.

Marshall, Richard A. and John T. Glover
1974 Archaeological survey of Tishomingo State Park and environs, Tishomingo County, Mississippi. Department of Anthropology, Mississippi State University.

Martin, Alexander C. and W.D. Barkley
1973 Seed Identification Manual. University of California Press, Berkeley.

Mehringer, Peter J., Jr.
1967 Pollen analysis of the Tula Springs area, Nevada. Nevada State Museum Anthropology Papers 13:129-200.

Meixner, R.E. and M.J. Singer
1985 Phosphorus fractions from a chronosequence of alluvial soils. San Joaquin Valley, California. Soil Science 139:37-46.

Menzel, R.G.
1980 Enrichment ratios for water quality modeling. In CREAMS: A Field-Scale Model for Chemicals, Runoff, and Erosion from Agriculture Management Systems. U.S. Agricultural Conservation Resources Report.

Moody, Ula L.
1972 Phytoliths as an interpretive device of paleoenvironments in archaeological sites. Unpublished Master's Thesis. Department of Geology, University of Montana.

Morrow, Carol A. and Richard W. Jeffries
1981 Prehistoric chert exploitation at the Black Earth site, Carrier Mills, Illinois. Paper presented at the Conference on Prehistoric Chert Exploitation, Carbondale, Illinois.

1982 Curational theory as a means of determining the role of lithic material in cultural systems. Paper presented at the 47th Annual Meeting, Society for American Archaeology.

Morse, D.F.
1967 The Robinson site and shell mound Archaic cultures in the middle South. Unpublished PhD. dissertation, University of Michigan.

Muto, Guy R. and Joel Gunn
1985 A study of Late Quaternary environments and Early Man along the Tombigbee River, Alabama and Mississippi. Final report submitted to the National Park Service by Benham Blair and Affiliates, Oklahoma City.

Newcomer, M.H. and L.H. Keeley
1979 Testing a nethos of microwear analysis with experimental flint tools. In Lithic Use-Wear Analysis, edited by Brian Hayden, pp. 195-206. Academic Press.

Nielsen, Jerry J. and Ned J. Jenkins
1973 Archaeological investigations in the Gainesville Lock and Dam Reservoir: 1972. Report submitted to the National Park Service, Tallahassee.

Nielsen, Jerry J. and Charles W. Moorehead
1972 Archaeological investigations in the Gainesville Lock and Dam Reservoir, Tennessee-Tombigbee Waterway. Report submitted to the National Park Service, Tallahassee.

Oakley, Carey B. and Eugene M. Futato
1975 Archaeological Investigations in the Little Bear Creek Reservoir. Report submitted to the Tennessee Valley Authority by the Office of Archaeological Research, University of Alabama. Research Series 1.

Odell, George H.

1975 Micro-wear in perspective: a sympathetic response to Lawrence H. Keeley. *World Archaeology* 7(2):226-239.

1977 The application of micro-wear analysis to the lithic component of an entire prehistoric settlement: methods, problems and functional reconstruction. PhD dissertation, Harvard University, University Microfilms, Ann Arbor.

1979 A new and improved system for the retrieval of functional information from microscopic observation of chipped stone tools. In *Lithic Use-Wear Analysis*, edited by Brian Hayden, pp. 329-344 Academic Press.

1980 Toward a more behavorial approach to archaeological lithic concentrations. *American Antiquity* 45:404-431.

1982 A diachronic view of lithic assemblages from a stratified site in the lower Illinois valley. Paper presented at the 47th Annual Meeting, Society of American Archaeology, Minneapolis.

Odell, George and Frieda Odell-Vereeken

1980 Verifying the reliability of lithic use-wear assessments by 'blind tests': the low-power approach. *Journal of Field Archaeology* 7:87-120.

O'Hear, John W.

1978 *The W.C. Mann site (22It565).* Report submitted to the National Park Service by the Department of Anthropology, Mississippi State University.

O'Hear, John W. and Thomas L. Conn

1977 *Archaeological salvage excavations at the L.A. Strickland I site (22Ts765), Tishomingo County, Mississippi.* Report submitted to the National Park Service by the Department of Anthropology, Mississippi State University.

O'Hear, John W., J.E. Rafferty, J.C. Phillips, and R. Walling

1985 *Archaeological investigations in the Divide-Cut Section Tennessee-Tombigbee Waterway*. Report submitted to the National Park Service by the Cobb Institute of Archaeology, Mississippi State University.

Oswalt, Wendell H.

1973 *Habitat and Technology*. Holt, Rinehart and Winston.

1976 *An anthropological analysis of food-getting technology*. John Wiley, New York.

Otinger, Jeffrey L. and Robert H. Lafferty, III

1980 The depositional implications of Archaic structures at the Brinkley Midden, Tishomingo County, Mississippi. *Southeastern Archaeological Conference Bulletin* 22:101-110.

Otinger, Jeffery L., C.M. Hoffman, and R.H. Lafferty, III
1982 The Brinkley site (22Ts729): archaeological investigations in the Yellow Creek watershed, Tishimingo County, Mississippi. Office of Archaeological Research, University of Alabama.

Parker, Malcolm
1974 The Owl Creek People: A Preliminary Report on the Hart site, 40 WM 14.

Parsons, R.B., W.H. Scholtes, and F.F. Rickens
1962 Soils of Indian Mounds in northeastern Iowa as benchmarks for studies of soil genesis. Soil Science Society American Proceedings 26:491-496.

Patterson, L.W.
1979 Quantitative characteristics of debitage from heat-treated chert. Plains Anthropologist 24(85):255-260.

Patterson, L.W. and J.B. Sollberger
1976 Replication and classification of small-size lithic debitage. Plains Anthropologist 23(80):103-112.

Peebles, Christopher S.
1978 Determinates of settlement size and location in the Moundville phase. In Mississippian settlement patterns, edited by Bruce D. Smith. Academic Press.

1983 An overview of research of the Lubbub Creek archaeological locality. In Excavations in the Lubbub Creek archaeological locality: Prehistoric agricultural communities in West Central Alabama. Volume I, edited by C.S. Peebles, pp. 70-129. Final report submitted to the Interagency Archaeological Services and U.S. Army Corps of Engineers, Mobile.

Peech, M.
1965 Exchange acidity. In Methods of Soil Analysis, Part I., edited by C.A. Black. Agronomy 9:914-926. American Society of Agronomy, Madison.

Penman, John T.
1977 Archaeological Survey in Mississippi, 1974-1975. Mississippi Department of Archives and History, Archaeological Report 2.

Pertulla, Timothy
1981 Patterns of prehistoric lithic raw material utilization in the Caddoan area: the western Gulf Coast plain. Paper presented at the Conference on Prehistoric Chert Exploitation, Carbondale, Illinois.

Peterson, Drexel A., Jr.
n.d. W.C. Mann site, 22Ts565. Edited by David Dye. Final report submitted to U.S. Army Corps of Engineers, Nashville District by the Department of Anthropology, Mississippi State University.

Peterson, G.W. and R.B. Corey
1966 A modified Chang and Jackson procedure for routine fractionation of inorganic soil phosphates. Soil Science Society American Proceedings 30:563-565.

Pettry, D.E.
1977 Soil Resource Areas of Mississippi. Information Sheet 178, Mississippi Agricultural Experimental Station, Mississippi State University.

Phelps, David S.
1968 Thomas Creek ceramics in the central Savannah River locality. Florida Anthropologist 21:17-30.

Pielou, E.C.
1975 Ecological Diversity. John Wiley and Sons, New York.

Phillips, Philip
1970 Archaeological survey in the lower Yazoo basin, Mississippi, 1949-1955. Harvard University, Peabody Museum of American Archaeology and Ethnology, Paper 25.

Purdy, Barbara A.
1971 Investigations concerning the thermal alteration of silica minerals: an archaeological approach. PhD dissertation, University of Florida, University Microfilms, Ann Arbor.

1974 Investigations concerning the thermal alteration of silica minerals: an archaeological approach. Tebiwa 17(1):37-66.

Purdy, Barbara A. and J.K. Brooks
1971 Thermal alteration if silica minerals: an archeological approach. Science 173:322-325.

Raab, L. Mark, Robert Cande and David W. Stahle
1979 Debitage graphs and Archaic settlement patterns in the Arkansas Ozarks. Midcontinental Journal of Archaeology 4(2):167-182.

Radford, Albert E., H.E. Ahles and C.R Bell
1968 Manual of the Vascular Flora of the Carolinas. University of North Carolina Press, Chapel Hill.

Rafferty, Janet E., B. Lea Baker, and Jack D. Elliott, Jr.
1980 Archaeological investigations at the East Aberdeen site (22Mo819), Tombigbee multi-resource district, Alabama and Mississippi. Final report submitted to the National Park Service.

Rands, Robert L.
1959 The Wells site: Poverty Point-Woodland remains on the Pearl River, Mississippi. Southeastern Archaeological Conference, Newsletter 6:15-18.

Reidhead, Van A.
1976 Optimization and food procurement at the prehistoric Leonard Haag site, southeastern Indiana: a linear approach. PhD. dissertation, Indiana University, University Microfilms, Ann Arbor.

1980 The economies of subsistence change: a test of and optimization model. In *Modeling change in prehistoric subsistence economies*, edited by Timothy R. Earle and Andrew L. Christenson, pp. 141-186.

Rick, John Winfield
1978 *Heat-altered cherts of the lower Illinois valley*. Northwestern University Archaeological Program, Prehistoric Records 2.

Rovner, Irwin
1971 Potential of opal phytoliths for use in paleoecological reconstruction. *Quanternary Research* 1:343-359.

Rucker, Marc D.
1974 *Archaeological survey and test excavations in the Upper-Central Tombigbee River Valley: Aliceville-Columbus Lock and Dam Impoundment areas, Alabama and Mississippi*. Report submitted to the National Park Service by the Department of Anthropology, Mississippi State University.

Ruhe, R.V., R.D. Hall, and A.P. Canepa
1974 Sangamon paleosols of Southwestern Indiana, U.S.A. *Geoderma* 12:191-200.

Schiffer, Michael B.
1976 *Behavorial Archaeology*. Academic Press.

Sears, William H. and James B. Griffin
1950 Fiber-tempered pottery of the southeast. In *Prehistoric Pottery of the eastern United States*, edited by J.B. Griffin. University of Michigan, Museum of Anthropology.

Sheets, Payson
1975 Behavorial analysis and the structure of a prehistoric industry. *Current Anthropology* 16(3):369-391.

Shenkel, J. Richard
1980 *Oak Island archaeology: prehistoric estuarine adaptations in the Mississippi River delta*. University of New Orleans, Archaeological and Cultural Research Program. Report submitted to Jean Lafitte National Historical Park.

Shenkel, J. Richard and George Holley
1975 A Tchefuncte house. *Southeastern Archaeological Conference Bulletin* 18:226-242.

Sheldon, Elisabeth S.
1981 Botanical Remains from Archaic Period Sites in the Upper Tombigbee Valley. Paper presented at the annual meeting of Society for Economic Botany, Boston.

Shoot, Michael J.
1984 Forager Mobility and Technological Organization. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland.

Smith, Brent W.
1981 A Late Archaic-Poverty Point steatite trade network in the lower Mississippi Valley: some preliminary observations. Florida Anthropologist 34:120-125.

Smith, Bruce D.
1978 Prehistoric Patterns of Human Behavior: A Case Study in the Mississippi Valley. Academic Press.

Smith, Eric Alden
1979 Human adaptation and energy efficiency. Human Ecology 7(2):53-74.

Soil Taxonomy
1975 U.S. Department Agriculture Handbook 436. U.S. Government Printing Office, Washington, D.C. pp. 14-17.

Solis, Carlos and Richard Walling
1982 Archaeological Investigations at the Yarborough site (22Cl1814) Clay County, Mississippi. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama.

Springer, M.E.
1958 Desert pavement and vesicular layers of some soils of the desert of Lohotan Basin, Nevada. Soil Science American Proceedings 22:63-55.

Stephenson, L.Q. and W.H. Monroe
1940 The Upper Cretaceaus Deposits. Mississippi State Geological Survey Bulletin 40:61-94.

Stephens, C.G.
1965 Climate as a factor of soil formation through the Quarternary. Soil Science 99:9-14.

Stephenson, L.Q. and W.H. Monroe
1940 The Upper Createaceous deposits. Mississippi State Geological Survey Bulletin 40.

Steponaitis, Vincas P.
1980 Some preliminary chronological and technological notes on Moundville pottery. Southeastern Archaeological Conference Bulletin 22:46-51.

1985 Ceramics, Chronology, and Community Patterns: An Archaeological Study at Moundville. Academic Press.

Stevenson, Marc G.
1985 The formation of artifact assemblages at workshop/habitation sites: models from Peace Point in northern Alberta. American Antiquity 50(1):63-81.

Steward, Julian H.
1955 Theory of culture change: the methodology of multilinear evolution. University of Illinois Press, Urbana.

Stoltman, James B.
1972 The Late Archaic in the Savannah River region. In Fiber-tempered Pottery in the southeastern United States and northern Columbia: its origins, context, and significance, edited by R.P. Bullen and J.B. Stoltman, pp. 37-62. Florida Anthropological Society Publication 6.

1974 Groton Plantation: an archaeological study of a South Carolina locality. Harvard University, Peabody Museum of American Archaeology and Ethnology, Monograph 4.

Swanton, John R.
1946 Indians of the southeastern United States. Bureau of American Ethnology Bulletin 137.

Symonds, George W.D.
1958 Tree Identification Book. William Morrow and Co., Inc., New York.

Tan, K.H.
1982 Principles of Soil Chemistry. Marcel Dekker, Inc., New York. pp. 41-131.

Tan, K.H. and J.E. Giddens
1972 Molecular weights and spectral characteristics of humic and fluvic acids. Geoderma 8:221-229.

Thomas, David H.
1970 Archaeology's operational imperative: Great Basin projectile points as a test case. UCLA Archeology Survey, Annual Report 12:31-60.

1979 Archaeology. Holt, Rinehart, and Winston, New York.

Thomas, Prentice M. Jr., L.J. Campbell, C. S. Weed, M.T. Swanson, and K. Bagley-Baumgartner
1985 Archaeological Investigations at the Turtle Pond site (22It643) Itawamba County, Mississippi. Report submitted to the U.S. Army Corps of Engineers by New World Research, Inc.

Thorne, Robert M.
1976 A cultural resource survey of the Divide-Cut section, Tennessee-Tombigbee Waterway. Tishomingo County, Mississippi: 1975. Report submitted to the National Park Service by the Department of Sociology and Anthropology, University of Mississippi.

Thorp, J.
1965 The nature of the pedological record in the Quarternary, Soil Science 99:1-8.

Torrence, Robin
1983 Time budgeting and hunter-gatherer technology. In *Hunter-gatherer economy in prehistory: a European perspective*, edited by Geoff Bailey, pp. 11-22. Cambridge University Press.

Trickey, E. Bruce and Nicholas H. Holmes, Jr.
1971 A chronological framework for the Mobile Bay region. (revised, 1970). *Journal of Alabama Archaeology* 17:115-128.

Tringham, Ruth, G. Cooper, G. Odell, B. Voytek, and A. Whitman
1974 Experimentation in the formation of edge damage: a new approach to lithic analysis. *Journal of Field Archaeology* 1(1-2):171-196.

USDA Soil Conservation Service
1972 *Soil Survey Laboratory Methods*. Soil Survey Investigations Report 1. U.S. Government Printing Office, Washington, D.C.

USDA Soil Survey Staff
1951 *Soil Survey Manual*. Agricultural Handbook 18. U.S. Government Printing Office, Washington, D.C.

University of Alabama Museums
1970 *A preliminary archaeological survey of the proposed Gainesville Lock and Dam Reservoir on the Tombigbee River.* Report submitted to the National Park Service, Tallahassee.

Waddell, Eugene G.
1963 Thomas Creek Punctate. *Southeastern Archaeological Conference Newsletter* 9:3-5.

Walker, T.W.
1964 The significance of phosphorus in pedogenesis. In *Experimental Pedology*, edited by E.G. Hallsworth and D.V. Crawford, pp.295-315. Butterworths, London.

Walker, T.W. and J.K. Syers
1976 The fate of phosphorus during pedogensis. *Geoderma* 15:1-19.

Walthall, John A.
1980 *Prehistoric Indians in the Southeast, Archaeology of Alabama and the Middle South.* University of Alabama Press, University.

Walthall, John A., Clarence H. Webb, Stephen H. Stowe and Sharon I. Goad
1982 Galena analysis and Poverty Point trade. *Midcontinental Journal of Archaeology* 7:133-149.

Walthall, John A. and D.L. DeJarnette
1974 Copena burial caves. *Journal of Alabama Archaeology* 20:1-59.

Walthall, John A. and Ned J. Jenkins
1976 The Gulf Formational stage in southeastern prehistory. *Southeastern Archaeological Conference Bulletin* 19:43-49.

Watson, Patty Jo
1976 In pursuit of prehistoric subsistence: a comparative account of some contemporary flotation techniques. *Midcontinental Journal of Archaeology* 1:77-100.

Webb, Clarence H.
1982 The Poverty Point culture. *Louisana State University, School of Geoscience and Man* 17. (second edition, revised).

Webb, Clarence H., James A. Ford and Sherwood Gagliano
1970 Poverty Point and the American formative. Ms. on file. Department of Sociology and Anthropology, Auburn University, Montgomery.

Webb, William S. and David L. DeJarnette
1942 *An archaeological survey of Pickwick basin in the adjacent portions of the states of Alabama, Mississippi, and Tennessee.* Smithsonian Institution, Bureau of Ethnology, Bulletin 129.

Weigel, R.D., J.A. Holman and A.A. Paloumpis
1974 Vertebrates from Russell Cave. In *Investigations in Russell Cave*, edited by J.W. Griffin. National Park Service Publications in Archaeology 13.

Weinstein, Richard A.
1981 *Archaeological Investigations along Moore's Creek, Alcorn County, Mississippi.* Report submitted to the National Park Service, Atlanta. Coastal Environments, Baton Rouge, La.

Weissner, P.
1983 Style and social information in Kalahari San projectile points. *American Antiquity* 48(2):253-276.

White, Nancy M.
1981 *Archaeological Survey at Lake Seminole.* Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Cleveland Museum of Natural History. Archaeological Research Report 29.

White, Nancy M., Chung Ho Lee, and J.A. Bense
1983 *Archaeological Investigations in the Upper Tombigbee Valley: Mississippi: Phase II.* Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Cultural and Archaeological Research, University of West Florida. Report of Investigations 4.

Williams, Stephen
1968 *The Waring papers: the collected works of Antonio J. Waring, Jr.* Harvard University, Peabody Museum of American Archaeology and Ethnology, Paper 58.

Williams, Stephen and J. B. Stoltman
1965 An outline of southeastern United States prehistory with particular emphasis on the Paleo-Indian era. In *The Quarternary of the United States*, edited by H. E . Wright, Jr. and David G. Frey. Princeton University Press, New Jersey.

Wimberly, Steve B.
1960 Indian pottery from Clarke County and Mobile County, southern Alabama. Alabama Museum of Natural History, Museum Paper 36.

Wing, Elizabeth and Antoinette Brown
1979 Paleonutrition: Methods and Theory in Prehistoric Foodways. Academic Press.

Winterhalder, Bruce and E.A. Smith
1981 Hunter-gatherer foraging strategies: ethnographic and archaeological analyses. University of Chicago Press.

Wobst, H. Martin
1977 Stylistic behavior and information exchange. In For the Director: Research essays in the honor of James B. Griffin, edited by C.E. Cleland, pp. 317-342. Anthropological Papers, University of Michigan, Museum of Anthropology, 61.

Woodrick, Anne
1981 An analysis of the faunal remains from the Gainesville Lake area: Part II. Biocultural studies in the Gainesville Lake area. Volume 4. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Office of Archaeological Research, University of Alabama. Report of Investigations 14.

Wynn, Jack T. and James R. Atkinson
1976 Archaeology of the Okashua and Self sites, Mississippi. Report submitted to the U.S. Army Corps of Engineers, Mobile District by the Department of Anthropology, Mississippi State University.

Yarnell, Richard A.
1964 Aboriginal Relationships between Culture and Plant Life in the Upper Great Lakes Region. University of Michigan, Anthropological Papers 23.

Yellen, John
1977 Archaeological approaches to the present: model for reconstructing the past. Academic Press.

Yuan, T.L.
1959 Determination of exchangeable hydrogen in soil by a titration method. Soil Science 88:164-167.

Zary, Joseph V.
1979 Woodland management productivity. In Soil Survey of Itawamba County, Mississippi. United States Department of Agriculture.